

**NASA TECHNICAL
MEMORANDUM**

NASA TM X- 62,330

NASA TM X- 62,330

NASA-TM-X-62330) WIND TUNNEL
INVESTIGATION OF AERODYNAMIC
CHARACTERISTICS OF A SCALE MODEL OF A D5
BULLDOZER AND AN M109 SELF-PROPELLED 155
mm (NASA) 104 p HC \$7.25 CSCL 20D

N74-15973

Unclas
G3/12 28336

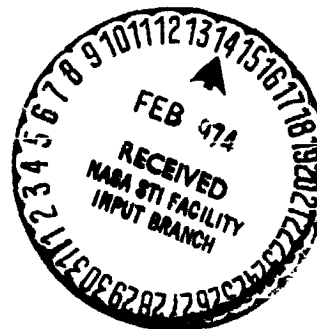
**WIND TUNNEL INVESTIGATION OF AERODYNAMIC CHARACTERISTICS
OF A SCALE MODEL OF A D5 BULLDOZER AND AN
M109 SELF-PROPELLED 155 MM HOWITZER**

Georgene H. Laub and Hifu M. Kodani

Ames Research Center

and

**U. S. Army Air Mobility R&D Laboratory
Moffett Field, California 94035**



January 1974

WIND TUNNEL INVESTIGATION OF AERODYNAMIC
CHARACTERISTICS OF A SCALE MODEL OF A
D5 BULLDOZER AND AN M109 SELF-PROPELLED 155 MM HOWITZER

By

Georgene H. Laub

And

Hifu M. Kodani

SUMMARY

Wind tunnel tests were conducted on a scale model of a D5 bulldozer and an M109 Self-Propelled 155 MM Howitzer to determine the aerodynamic characteristics of these typical externally-suspended heavy lift helicopter cargo configurations. Tests were made over a large range of pitch and yaw attitudes at a nominal Reynolds number per unit length of 1.5×10^6 . This report presents the aerodynamic data obtained from the tests.

INTRODUCTION

Operational requirements of heavy lift helicopters require the transportation of large cargo items at moderately high speeds. The aerodynamic characteristics of such externally-suspended cargo can adversely affect the stability of the helicopter-sling cargo system. A lack of experimental data on typical large cargo items seriously hinders theoretical predictions of the effects of such configurations on the performance and dynamics of the complete system.

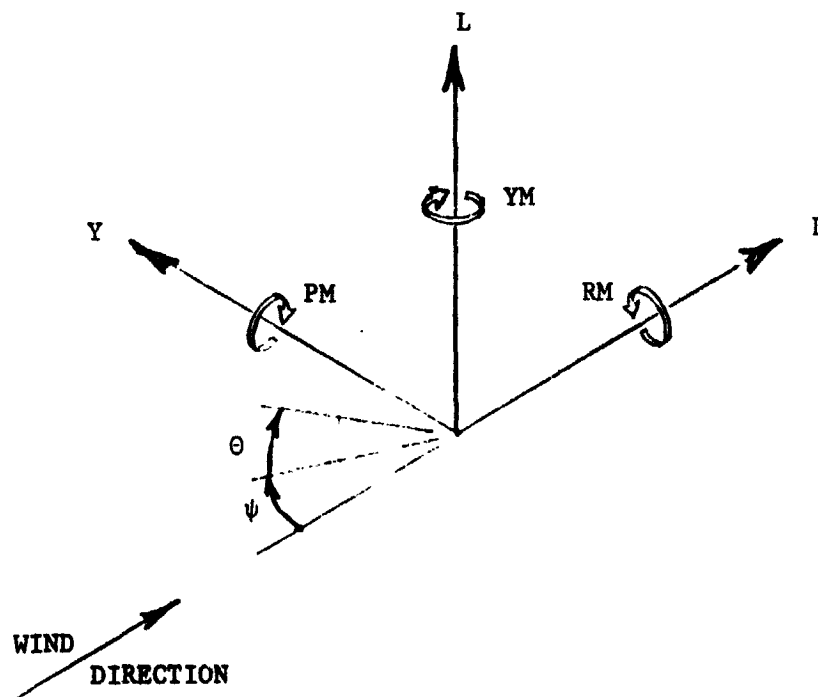
Wind tunnel tests were made on a model of a D5 bulldozer and an M109 Self-Propelled 155 MM Howitzer in the Army Air Mobility Research and Development Laboratory 7X10 Foot Wind Tunnel. The purpose of this report is to present the aerodynamic data obtained from tests on these two models.

NOTATION

b span
c chord
CD drag coefficient, D/qS
CL lift coefficient, L/qS
CPM pitching moment coefficient, PM/qSc
CRM rolling moment coefficient, RM/qSb
CY side force coefficient, Y/qS
CYM yawing moment coefficient, YM/qSb
D drag force

L lift force
 PM pitching moment
 q dynamic pressure
 RM rolling moment
 Y side force
 YM yawing moment
 θ pitch angle
 ψ yaw angle

Positive Directions as Shown



DESCRIPTION OF MODELS

Two heavy lift helicopter externally-suspended cargo items representative of those currently in wide use throughout the military transport system were selected for this wind tunnel investigation - a D5 Bulldozer and an M109 Self-Propelled 155 MM Howitzer. Models of these two configurations were sized to maximize Reynolds number in the test section for the full range of model pitch and yaw angles. The bulldozer model, constructed with a detachable blade, was 1/5 scale; the M109 model was 1/8 scale. Photographs of each model are presented in Figures 1 and 2. The models were sting mounted and, with the exception of the bulldozer/blade configuration, tested in both a forward and reversed position. Model loads were measured using an internal strain gage balance. Photographs showing the models mounted in the tunnel are presented in Figures 3 and 4.

TEST AND PROCEDURES

The three D5 Bulldozer model configurations and the two M109 model configurations tested in the 7X10 foot wind tunnel are shown in Figures 3 and 4. Except for two tests, the M109 model was tested without the machine gun. Yaw attitude was varied using the tunnel turntable system; pitch attitude was varied using the pitching mechanism of the sting/strut support system. Model aerodynamic loads were measured using an internal strain gage balance; model moment reference center, as shown in Figure 5, and strain gage balance center coincided.

Except as noted, the tests were conducted at a nominal tunnel dynamic pressure of 3591 N/m^2 (75psf) with a corresponding Reynolds number based on unit length of 1.5×10^6 . Test data were taken varying pitch attitude at constant angles of yaw through a yaw range of -90° to 95° . Negative sting pitch angles were limited to -12° to avoid model-strut interference effects due to proximity of the model with the strut. The models, including strain gage balance, were rotated 180° on the sting and tested in this inverted position to provide data through a model pitch range of -40° to 40° . As a result of this inversion, two sets of data were obtained in the -12° to 12° pitch attitude range.

Model configurations and attitudes were necessarily held to a minimum on the following additional comparative-type tests. Tests with the machine gun mounted on the M109 model were limited to yaw attitudes of 0° and 90° and a pitch angle range of -12° to 40° . To provide an indication of Reynolds number effect the three forward model configurations were tested at 1197 N/m^2 (25psf) or a Reynolds number of 0.9×10^6 based on unit length. These tests were made at a yaw attitude of 0° and through the -12° to 40° pitch angle range. Two tests on the M109 forward configuration were repeated at 0° and 90° yaw attitude through the -12° to 40° pitch angle range for a check on data repeatability.

PRESENTATION OF DATA

The results of the tests on the models are presented in tabular form; tables and model test attitudes are indexed in Table I.

Model aerodynamic data are presented as full scale aerodynamic coefficients; these coefficients are based on unit values for chord,

span, and area to facilitate, upon multiplication by the dynamic pressure, a direct conversion to the aerodynamic loads. The full scale aerodynamic coefficients presented in the tables were obtained by multiplying the model force coefficients by the scale factor squared and model moment coefficients by scale factor cubed. The appropriate constants are listed below.

<u>Model</u>	<u>Force Data</u> (scale factor) ²	<u>Moment Data</u> (scale factor) ³
D5 Bulldozer	25.0	125.0
M109	64.0	512.0

Forces and moments are resolved with respect to wind axes; moments are referenced to the moment reference center shown in Figure 5. Data from the additional tests (Tables VII, VIII, and IX) are presented, as the aerodynamic coefficients and also include the incremental value between these data and the comparative data from Tables II thru VI. The non-aerodynamic shape of the model, insuing rough tunnel flow and model vibrations resulted in a correspondingly large data repeatability scatter band especially at the more extreme angles. Data from the tests to evaluate the effect of Reynolds number and the effect of machine gun were essentially lost in the data repeatability scatter band. Since model testing positions were selected to exclude those regions necessitating model-strut interference effect corrections, none are accounted for in the data.

To provide a visual indication of the aerodynamic characteristics

of the five configurations tested, some data were selected from Tables II through VI and plotted. These data are presented in Figures 6 through 10. Parts (a) and (b) of each of these figures present the force and moment coefficients plotted against pitch angle at 0 degrees yaw angle. The force and moment coefficient variation with yaw angle are shown in parts (c) and (d) for pitch angles of -16, 0, and 16 degrees.

TABLE I. - INDEX TO DATA TABLES

TABLE NO.	TITLE	PITCH ANGLE RANGE, DEG.	YAW ANGLE POSITIONS, DEG.
II	D5 BULLDOZER FORWARD CONFIGURATION	-40 TO 40	-90,-60,-30,0,4,8,16,30,60,75,90,95
III	D5 BULLDOZER/BLADE CONFIGURATION	-40 TO 40	-90,-60,-30,0,8,16,30,60,90
IV	D5 BULLDOZER REVERSE CONFIGURATION	-40 TO 40	-90,-60,-30,0,4,8,16,30,45,60,75,90,95
V	M109 FORWARD CONFIGURATION	-40 TO 40	-90,-60,-30,0,4,8,16,30,45,60,75,90,95
VI	M109 REVERSE CONFIGURATION	-40 TO 40	-90,-60,-30,0,4,8,16,30,45,60,75,90,95
VII	M109 FORWARD CONFIGURATION WITH MACHINE GUN	-12 TO 40	0,90
VIII	REYNOLDS NO. = .9 X 10**6 DATA	-12 TO 40	0
IX	M109 FORWARD CONFIGURATION DATA REPEATABILITY CHECK	-12 TO 40	0,90

TABLE II.- DS BULLDOZER FORWARD CONFIGURATION

YAW ANGLE = -90. DEG.

PITCH ANGLE (DEG.)	LIFT FORCE COEF.	DRAW FORCE COEF.	SIDE FORCE COEF.	PITCHING MOMENT COEF.	YAWING MOMENT COEF.	ROLLING MOMENT COEF.
-40.	4.0	61.4	-11.6	35.9	74.5	22.4
-35.	3.5	61.0	-10.2	28.8	76.9	24.4
-30.	3.4	60.9	-9.7	22.1	80.1	27.4
-25.	4.4	61.5	-8.9	14.6	80.5	24.5
-20.	5.7	60.7	-9.1	7.6	80.4	25.5
-15.	8.1	60.2	-9.1	3.0	80.7	22.1
-12.	6.3	61.0	-8.2	-2.6	80.0	24.3
-8.	10.9	60.5	-8.1	-7.1	81.0	16.7
-4.	9.7	60.5	-7.2	-13.4	79.6	10.5
0.	10.0	60.7	-6.1	-18.9	77.7	11.8
4.	10.6	60.2	-5.7	-23.6	77.3	21.5
8.	11.0	59.9	-5.3	-29.3	76.0	19.8
12.	10.7	60.3	-4.7	-34.8	73.5	18.1
16.	9.1	58.0	-4.2	-41.7	70.3	18.9
20.	8.1	59.0	-3.9	-46.7	69.2	24.8
25.	11.2	59.3	-1.5	-53.4	64.1	27.7
30.	9.2	59.0	-2.9	-56.8	58.0	22.2
35.	11.0	57.8	1.1	-61.1	53.2	28.8
40.	11.4	59.2	1.4	-65.6	40.6	22.1
						23.3

YAW ANGLE = -60. DEG.

PITCH ANGLE (DEG.)	LIFT FORCE COEF.	DRAG FORCE COEF.	SIDE FORCE COEF.	PITCHING MOMENT COEF.	YAWING MOMENT COEF.	POLLING MOMENT COEF.
-40.	-4.9	73.6	-26.6	12.2	63.8	-17.1
-35.	-4.7	72.2	-26.2	6.0	62.9	-16.9
-30.	-1.7	69.9	-26.6	-2.3	58.5	-16.8
-25.	-3.7	69.1	-25.5	-7.4	51.5	-6.2
-20.	-4.2	69.0	-25.7	-14.4	43.7	0.3
-15.	-3.9	67.3	-25.7	-16.2	38.3	7.2
-12.	-2.0	67.5	-26.2	-20.5	31.3	9.9
-8.	0.8	66.6	-27.0	-23.1	23.7	15.2
-4.	0.9	65.4	-26.9	-24.6	16.7	19.5
0.	3.5	65.0	-26.1	-30.0	14.1	19.3
4.	4.6	64.0	-24.4	-32.4	8.5	22.4
8.	6.6	64.0	-23.7	-34.6	4.8	28.2
12.	8.4	63.8	-22.4	-35.2	0.3	36.3
16.	11.8	64.0	-22.3	-24.5	-6.8	44.2
20.	13.4	64.8	-20.5	-21.3	-9.6	48.8
25.	15.3	65.0	-18.3	-17.4	-11.6	51.6
30.	17.6	65.1	-15.6	-15.5	-12.0	40.9
35.	19.3	64.9	-12.9	-13.1	-11.3	48.3
40.	20.8	66.4	-9.4	-24.2	-7.4	45.0

TABLE 11.- D5 BULLDOZER FORWARD CONFIGURATION (CONTINUED)

YAW ANGLE= -30. DEG.

PITCH ANGLE (DEG.)	LIFT FORCE COEF.	DRAG FORCE COEF.	SIDE FORCE COEF.	PITCHING MOMENT COEF.	YAWING MOMENT COEF.	ROLLING MOMENT COEF.
-40.	-20.0	67.4	-18.9	3.1	25.7	10.6
-35.	-18.4	62.7	-21.8	3.8	27.4	13.9
-30.	-15.2	58.9	-23.3	0.5	33.8	13.1
-25.	-15.8	56.3	-23.9	-10.8	32.8	17.0
-20.	-20.4	55.3	-22.4	-17.7	30.3	32.3
-16.	-19.9	53.6	-22.3	-14.9	25.4	40.8
-12.	-15.6	51.0	-23.1	-15.2	18.3	42.0
-8.	-18.9	48.7	-23.2	-11.3	10.9	41.3
-4.	-7.3	47.0	-23.5	-4.5	2.9	40.9
0.	-2.9	45.9	-23.2	3.4	0.3	40.1
4.	2.8	45.6	-22.0	8.1	-3.1	36.0
8.	11.1	46.4	-21.1	12.5	-1.6	32.8
12.	17.1	47.1	-18.1	14.9	0.0	32.4
16.	23.2	48.4	-17.1	6.7	-7.2	26.2
20.	29.2	49.6	-14.2	6.3	-11.3	24.7
25.	34.7	52.8	-11.7	4.2	-11.4	23.3
30.	40.0	56.8	-8.0	0.9	-11.8	20.8
35.	44.9	62.2	-4.3	-3.6	-11.2	19.3
40.	47.7	66.0	-0.2	-6.8	-9.0	16.3
	47.3	69.3				14.7

TABLE II.- D5 BULLDOZER FORWARD CONFIGURATION (CONTINUED)

PITCH ANGLE (DEG.)	YAW ANGLE= 0. DEG.	LIFT FORCE COEF.	DRAG FORCE COEF.	SIDE FORCE COEF.	PITCHING MOMENT COEF.	YAWING MOMENT COEF.	ROLLING MOMENT COEF.
-40.		-31.3	47.3	0.5	-26.5	-1.5	1.1
-35.		-31.6	43.3	0.8	-33.4	-0.9	1.3
-30.		-31.1	39.1	-0.2	-33.5	0.7	0.5
-25.		-29.4	34.4	0.5	-26.8	-0.4	0.9
-20.		-25.5	29.8	0.2	-17.6	-1.6	0.7
-15.		-21.9	26.9	0.8	-8.6	-1.7	0.6
-12.		-18.4	25.1	0.7	-0.8	-1.5	0.5
-8.		-14.5	23.2	0.2	8.3	-0.3	0.6
-4.		-10.0	21.4	0.0	16.8	1.6	1.5
0.		-5.2	21.0	0.8	22.6	2.7	1.3
4.		0.9	20.4	1.8	25.8	1.0	0.4
8.		5.4	21.1	0.5	29.3	-0.1	0.3
12.		6.9	21.9	1.0	41.0	1.2	0.3
16.			26.2	-0.0	39.1	2.4	0.0
20.			29.7	1.5	39.2	5.2	0.5
25.			33.8	-0.1	44.4	1.2	1.3
30.			44.3	0.3	30.1	-1.3	0.6
35.			48.9	2.1	26.5	3.0	-5.0
40.			58.0	1.3	8.1	1.9	-1.7

TABLE 11.- 05 BULLDOZER FORWARD CONFIGURATION (CONTINUED)

PITCH ANGLE (DEG.)	YAW ANGLE= 4. DEG.	LIFT FORCE COEF.	DRAG FORCE COEF.	SIDE FORCE COEF.	PITCHING MOMENT COEF.	YAWING MOMENT COEF.	POLLING MOMENT COEF.
-40.		-29.7	49.2	2.7	-18.9	-11.2	3.3
-35.		-30.8	45.2	2.2	-24.7	-8.9	1.2
-30.		-30.7	42.1	4.3	-26.0	-7.6	-0.0
-25.		-28.6	38.3	5.1	-20.5	-7.0	-0.8
-20.		-24.1	33.5	6.3	-11.0	-7.1	-2.1
-16.		-20.3	30.9	5.7	-1.8	-13.2	-2.8
-12.		-18.0	28.8	5.6	9.8	-14.1	-3.5
-8.		-14.4	26.0	4.7	15.6	-11.5	-2.2
-4.		-9.8	24.5	3.9	20.6	-8.8	-1.6
0.		-4.9	23.3	3.2	26.4	-6.8	-2.7
4.		-0.1	22.3	5.1	32.8	-4.6	-3.0
8.		3.3	22.9	5.4	42.5	-0.8	-2.0
12.		8.6	24.7	4.6	46.1	-1.3	-4.3
16.		18.1	26.4	5.6	38.2	2.4	-3.7
20.		24.4	30.2	4.4	39.4	1.3	-4.6
25.		29.6	35.8	4.9	38.0	-1.7	-5.4
30.		32.9	44.3	4.3	37.8	0.9	-5.6
35.		37.7	49.6	2.2	29.2	-0.4	0.5
40.		41.4	57.5	-1.7	25.5	-1.0	-0.9
					9.4	-4.5	7.4

TABLE II.- D5 BULLDOZER FORWARD CONFIGURATION (CONTINUED)

PITCH ANGLE (DEG.)	YAW ANGLE= 8. DEG.	LIFT FORCE COEF.	DRAG FORCE COEF.	SIDE FORCE COEF.	PITCHING MOMENT COEF.	YAWING MOMENT COEF.	ROLLING MOMENT COEF.
-40.		-28.6	52.2	2.4	-9.7	-15.2	2.7
-35.		-30.0	49.1	5.8	-18.6	-15.2	2.3
-30.		-29.0	46.0	8.8	-22.3	-13.6	2.0
-25.		-26.6	42.1	9.6	-18.9	-11.5	1.8
-20.		-22.1	37.6	9.1	-5.9	-17.4	-1.4
-16.		-19.6	34.9	10.2	-0.0	-21.9	-3.2
-12.		-17.5	32.8	10.2	7.9	-23.7	-5.6
-8.		-14.3	30.3	9.3	17.0	-20.7	-6.2
-4.		-9.6	28.3	9.0	23.2	-19.3	-5.9
0.		-5.0	26.4	9.0	28.8	-7.5	-6.4
4.		0.2	25.5	8.6	32.3	-5.0	-6.7
8.		4.9	26.4	10.0	37.2	-3.7	-8.9
12.		10.0	27.7	11.1	41.5	-2.3	-11.1
16.		19.1	27.5	10.8	40.0	2.3	-8.1
20.		23.8	28.6	11.9	36.1	0.7	-9.1
25.		21.9	32.4	12.0	35.2	-0.4	-10.8
30.		33.1	34.6	11.9	47.1	-1.0	-10.8
35.		37.8	45.7	9.1	25.4	0.0	-3.2
40.		42.3	52.1	4.7	19.1	-1.1	1.3
			59.1	1.3	10.5	-2.8	7.7

TABLE II.- D5 BULLDOZER FORWARD CONFIGURATION (CONTINUED)

YAW ANGLE= 16. DEG.

PITCH ANGLE (DEG.)	LIFT FORCE COEF.	DRAG FORCE COEF.	SIDE FORCE COEF.	PITCHING MOMENT COEF.	YAWING MOMENT COEF.	ROLLING MOMENT COEF.
-40.	-27.7	59.2	12.5	-4.5	-17.3	-0.2
-35.	-26.8	56.2	14.8	-14.4	-9.6	0.3
-30.	-26.9	53.4	16.9	-21.0	-10.8	1.1
-25.	-20.6	48.5	18.8	-8.9	-25.5	0.9
-20.	-19.2	45.6	20.1	-5.4	-26.6	-3.7
-16.	-19.0	42.8	19.6	1.0	-30.8	-9.9
-12.	-16.8	39.9	18.3	8.7	-28.2	-13.1
-8.	-14.0	38.1	16.5	15.5	-24.3	-14.6
-4.	-7.1	36.8	17.0	15.3	-21.8	-14.0
0.	-0.6	33.3	16.9	17.0	-17.4	-15.3
4.	4.0	34.7	17.4	21.6	-12.0	-16.0
8.	9.5	34.4	16.9	25.1	-7.2	-17.6
12.	15.2	36.6	17.8	29.6	-2.6	-19.0
16.	26.1	39.2	15.8	22.1	-4.0	-16.4
20.	30.7	43.0	14.0	21.2	-5.7	-12.6
25.	34.4	49.4	13.7	16.0	1.2	-7.5
30.	36.6	53.6	10.1	15.1	5.9	-1.7
35.	41.5	59.0	7.3	9.1	3.6	1.0
40.	45.5	64.6	2.6	2.7	2.2	3.4

TABLE II.- D5 BULLDOZER FORWARD CONFIGURATION (CONTINUED)

YAW ANGLE= 30. DEG.

PITCH ANGLE (DEG.)	LIFT FORCE COEF.	DRAG FORCE COEF.	SIDE FORCE COEF.	PITCHING MOMENT COEF.	YAWING MOMENT COEF.	ROLLING MOMENT COEF.
-40.	-21.9	70.7	21.7	1.5	-20.0	-12.5
-35.	-19.6	65.7	24.8	2.1	-25.3	-13.6
-30.	-15.7	61.6	27.1	0.9	-31.7	-14.9
-25.	-15.9	58.3	27.6	-10.8	-28.1	-15.8
-20.	-18.5	56.4	27.5	-14.3	-23.3	-29.1
-16.	-18.0	55.0	27.3	-16.0	-17.8	-37.2
-12.	-16.4	54.0	28.0	-15.1	-12.5	-40.0
-8.	-12.4	51.2	27.2	-11.2	-5.7	-39.0
-4.	-8.5	49.2	28.3	-6.0	1.8	-37.0
0.	-4.8	48.0	27.6	2.2	5.5	-36.4
4.	0.6	47.8	27.5	7.7	5.8	-33.4
8.	7.4	48.3	25.6	12.1	8.6	-30.9
12.	14.5	49.4	24.4	12.5	5.6	-29.8
16.	30.9	51.0	18.2	5.8	12.6	-21.1
20.	34.7	53.5	15.3	4.4	14.4	-17.9
25.	40.3	59.1	13.0	4.4	11.0	-17.6
30.	46.4	63.7	8.6	-0.1	9.4	-15.4
35.	42.3	69.0	10.4	-0.6	13.0	-6.0
40.	47.4	73.4	1.8	-6.9	10.6	-5.9

TABLE II.- D5 BULLDOZER FORWARD CONFIGURATION (CONTINUED)

YAW ANGLE= 60. DEG.

PITCH ANGLE (DEG.)	LIFT FORCE COEF.	DAG FORCE COEF.	SIDE FORCE COEF.	PITCHING MOMENT COEF.	YAWING MOMENT COEF.	ROLLING MOMENT COEF.
-40.	-4.3	77.5	28.9	8.5	-62.2	14.2
-35.	-3.8	75.4	27.5	-0.4	-60.4	18.7
-30.	-2.3	74.6	28.3	-6.6	-58.3	15.6
-25.	-2.5	72.5	27.8	-10.5	-52.4	6.0
-20.	-5.2	72.5	26.9	-17.5	-46.1	2.0
-16.	-4.2	71.8	26.8	-19.7	-37.3	-5.8
-12.	-1.9	71.0	27.2	-21.5	-30.0	-11.6
-8.	-0.4	69.8	28.1	-24.4	-23.9	-13.6
-4.	1.0	69.1	29.4	-26.7	-16.5	-17.1
0.	2.2	68.5	28.9	-28.8	-8.6	-22.6
4.	3.0	68.6	29.2	-29.5	-5.6	-22.1
8.	8.2	67.3	27.4	-34.0	-2.6	-23.2
12.	8.9	67.3	26.4	-34.0	2.2	-19.7
16.	13.9	65.5	21.5	-26.7	5.4	-26.0
20.	16.6	65.3	19.7	-23.3	8.2	-36.1
25.	19.2	65.1	16.7	-18.6	12.1	-41.0
30.	21.5	65.1	13.7	-14.3	12.7	-44.0
35.	22.6	64.6	10.0	-14.0	13.2	-47.4
40.	22.3	66.3	6.9	-17.8	10.0	-45.0
				-23.5	7.5	-42.2
						-42.5

TABLE II.- D5 BULLDOZER FORWARD CONFIGURATION (CONTINUED)

YAW ANGLE= 75. DEG.

PITCH ANGLE (DEG.)	LIFT FORCE COEF.	DRAG FORCE COEF.	SIDE FORCE COEF.	PITCHING MOMENT COEF.	YAWING MOMENT COEF.	ROLLING MOMENT COEF.
-40.	-3.7	71.2	19.5	25.1	-64.2	1.3
-35.	-2.1	70.2	18.8	19.0	-64.8	1.8
-30.	-1.4	69.4	18.5	11.1	-63.8	2.2
-25.	-1.1	69.0	19.1	4.3	-61.5	1.4
-20.	0.0	69.5	20.7	-2.2	-62.3	0.8
-16.	1.2	68.8	19.9	-7.4	-60.0	2.9
-12.	-0.4	68.6	19.0	-11.4	-58.9	-3.4
-8.	2.1	68.1	19.3	-16.3	-56.2	-1.8
-4.	3.4	67.9	19.7	-21.0	-53.5	0.5
0.	3.4	67.4	19.8	-25.1	-48.6	-5.3
4.	3.4	66.9	19.1	-28.1	-45.3	-8.3
8.	4.8	65.9	19.6	-30.9	-42.6	-10.4
12.	6.0	65.5	17.4	-32.9	-37.1	-11.1
16.		63.3	17.4	-29.7	-23.0	-26.1
20.	11.5	63.8	15.5	-31.5	-20.1	-22.1
25.	11.1	63.2	15.1	-33.3	-16.3	-26.9
30.	11.8	63.3	13.8	-34.4	-13.5	-29.1
35.	13.5	62.9	11.2	-36.4	-9.8	-29.9
40.	13.9	62.9	10.0	-37.2	-5.8	-4.4

TABLE II.- D5 BULLDOZER FORWARD CONFIGURATION (CONTINUED)

YAW ANGLE= 90. DEG.

PITCH ANGLE (DEG.)	LIFT FORCE COEF.	DRAG FORCE COEF.	SIDE FORCE COEF.	PITCHING MOMENT COEF.	YAWING MOMENT COEF.	ROLLING MOMENT COEF.
-40.	2.0	62.2	9.8	32.9	-74.1	-16.7
-35.	1.7	61.9	9.1	25.4	-75.7	-18.9
-30.	2.9	61.4	9.4	19.3	-78.4	-15.3
-25.	6.8	62.3	7.3	7.2	-81.8	-10.6
-20.	6.3	61.4	7.5	7.4	-81.7	-10.2
-16.	6.7	61.5	8.2	1.4	-81.8	-9.6
-12.	6.7	61.5	8.0	-5.9	-79.1	-13.1
-8.	6.4	62.7	7.2	-10.6	-80.2	-12.5
-4.	8.9	62.2	6.6	-14.9	-78.6	-7.5
0.	8.3	62.1	6.1	-21.0	-77.2	-11.2
4.	11.1	61.3	5.7	-25.2	-76.6	-8.5
8.	9.0	61.7	5.4	-30.9	-71.2	-11.4
12.	9.7	62.6	4.0	-36.1	-71.2	-7.3
16.			4.2	-43.1	-66.8	-22.4
20.			3.8	-46.5	-63.1	-21.2
25.			3.6	-53.0	-59.7	-23.6
30.			2.5	-58.3	-55.1	-22.6
35.			1.7	-62.0	-49.7	-21.4
40.			1.4	-66.7	-45.0	-19.8

TABLE II.- 05 BULLDOZER FORWARD CONFIGURATION (CONCLUDED)

YAW ANGLE= 95. DEG.

PITCH ANGLE (DEG.)	LIFT FORCE COEF.	DRAW FORCE COEF.	SIDE FORCE COEF.	PITCHING MOMENT COEF.	YAWING MOMENT COEF.	ROLLING MOMENT COEF.
-40.	5.4	58.9	8.0	37.5	-83.0	-16.7
-35.	7.2	58.3	8.8	31.6	-86.2	-14.7
-30.	10.4	58.3	8.6	26.1	-87.8	-6.7
-25.	10.5	58.4	7.6	20.5	-91.5	-3.4
-20.	13.1	59.1	6.3	15.5	-96.6	0.7
-16.	13.7	59.4	5.2	8.0	-96.4	1.5
-12.	13.3	59.7	4.7	2.4	-99.8	2.1
-8.	12.7	61.5	1.6	-3.3	-95.7	3.0
-4.	13.0	63.4	-1.4	-7.7	-86.4	4.8
0.	10.8	64.4	-3.5	-13.9	-83.6	3.7
4.	10.9	64.0	-4.1	-18.8	-82.7	3.6
8.	10.9	65.4	-5.8	-23.3	-77.9	5.9
12.	9.1	66.3	-5.7	-29.6	-78.7	4.7
16.		59.0	-2.6	-45.2	-89.0	1.7
20.	13.4	58.9	-3.4	-50.1	-84.0	3.5
25.	13.4	59.7	-6.1	-57.3	-81.6	9.0
30.	12.7	59.3	-6.2	-62.5	-73.6	6.3
35.	12.5	59.9	-6.9	-69.5	-68.0	10.7
40.	11.3	61.1	-8.0	-74.7	-61.0	7.9

TABLE III.- D5 BULLDOZER / BLADE CONFIGURATION

YAW ANGLE = -90. DEG.

PITCH ANGLE (DEG.)	LIFT FORCE COEF.	DRAG FORCE COEF.	SIDE FORCE COEF.	PITCHING MOMENT COEF.	YAWING MOMENT COEF.	ROLLING MOMENT COEF.
-40.	4.0	70.5	-12.0	-23.8	13.2	24.9
-35.	3.9	70.3	-12.3	-25.8	9.6	29.6
-30.	5.2	70.2	-11.2	-25.8	6.3	25.0
-25.	6.1	69.6	-10.7	-26.0	4.2	25.1
-20.	4.1	70.2	-10.0	-27.1	1.4	28.9
-16.	7.6	70.2	-9.6	-27.4	-1.4	20.5
-12.	6.6	70.4	-8.5	-26.4	-2.1	25.9
-8.	7.5	69.7	-8.5	-26.5	-5.4	23.9
-4.	8.9	70.0	-7.9	-25.7	-5.9	20.7
0.	9.2	70.6	-7.5	-25.4	-8.8	20.9
4.	9.7	69.5	-6.5	-24.0	-9.9	21.9
8.	10.0	70.0	-6.0	-22.7	-11.2	20.3
12.	10.7	70.8	-4.8	-22.7	-14.1	19.2
16.	10.5	69.5	-3.3	-24.3	-13.8	26.4
20.	10.2	70.6	-3.3	-23.5	-17.8	30.1
25.	11.7	70.8	-2.1	-21.0	-18.0	26.5
30.	12.1	70.8	-1.3	-20.2	-21.6	28.4
35.	11.7	70.7	0.2	-17.6	-22.8	25.4
40.	12.5	71.4	2.6	-15.1	-23.2	25.6
						35.5
						31.3
						28.9
						31.9
						29.9
						32.1
						27.8
						26.4
						30.1
						26.5
						28.4
						25.4
						25.6

TABLE III.- D5 BULLDOZER / BLADE CONFIGURATION (CONTINUED)

YAW ANGLE = -60. DEG.

PITCH ANGLE (DEG.)	LIFT FORCE COEF.	DRAG FORCE COEF.	SIDE FORCE COEF.	PITCHING MOMENT COEF.	YAWING MOMENT COEF.	ROLLING MOMENT COEF.
-40.	0.3	98.5	-6.2	-101.4	24.1	-84.4
-35.	-0.5	95.6	-7.6	-104.6	17.8	-88.3
-30.	-3.0	93.3	-6.7	-106.1	11.1	-84.4
-25.	-6.8	90.8	-7.7	-104.6	0.2	-72.0
-20.	-9.1	89.9	-9.1	-104.6	-6.7	-71.2
-16.	-8.5	88.3	-9.8	-102.1	-11.9	-67.1
-12.	-10.4	86.1	-10.8	-97.7	-20.0	-60.8
-8.	-10.5	85.1	-11.5	-88.8	-29.3	-50.1
-4.	-7.5	83.2	-13.5	-80.6	-37.4	-42.6
0.	-5.7	81.5	-14.0	-75.3	-45.0	-36.1
4.	-3.8	80.3	-14.5	-66.8	-52.1	-28.9
8.	-0.2	78.5	-14.7	-58.2	-50.9	-23.5
12.	2.9	77.7	-14.0	-52.8	-55.3	-19.3
16.	6.4	77.6	-14.2	-48.4	-58.3	-13.6
20.	8.3	77.8	-12.0	-38.5	-63.4	-5.8
25.	8.8	78.4	-11.0	-26.7	-66.0	4.7
30.	10.7	78.9	-9.2	-17.7	-69.2	11.7
35.	12.6	79.3	-7.7	-11.0	-70.2	10.6
40.	15.7	79.2	-4.3	-5.5	-68.8	9.6
				5.6	-65.3	11.0
						17.5

TABLE III.- D5 BULLDOZER / BLADE CONFIGURATION (CONTINUED)

PITCH ANGLE (DEG.)	LIFT FORCE COEF.	DRAW FORCE COEF.	SIDE FORCE COEF.	PITCHING MOMENT COEF.	YAWING MOMENT COEF.	ROLLING MOMENT COEF.
-40.	-3.1	111.7	2.9	-147.9	57.3	-67.9
-35.	-7.4	107.1	1.0	-146.3	57.2	-65.0
-30.	-9.0	101.6	-0.8	-136.9	60.6	-61.2
-25.	-12.7	95.6	-2.0	-141.4	62.7	-64.0
-20.	-18.8	92.2	-2.0	-143.9	62.5	-59.0
-16.	-23.5	87.5	-2.6	-148.1	62.0	-53.3
-12.	-25.7	84.1	-3.1	-156.6	63.1	-52.1
-8.	-26.4	80.1	-4.7	-154.8	51.0	-43.2
-4.	-29.3	77.7	-5.5	-156.5	43.6	-33.3
0.	-26.1	74.2	-7.3	-143.2	35.9	-24.2
4.	-20.0	69.1	-8.5	-129.3	25.8	-27.1
8.	-8.7	65.0	-11.1	-118.3	7.6	-24.3
12.	-6.0	67.3	-10.9	-129.2	-3.4	-32.0
16.	6.9	72.0	-10.5	-144.8	-25.5	-55.7
20.	12.3	75.6	-7.1	-131.0	-28.4	-56.5
25.	20.5	79.6	-2.7	-108.2	-31.0	-47.0
30.	23.5	84.4	1.8	-87.1	-33.3	-38.0
35.	23.0	89.1	4.2	-70.9	-43.0	-37.2
40.	23.2	91.5	6.6	-46.0	-42.8	-27.7

TABLE III.- OS BULLDOZER / BLADE CONFIGURATION (CONTINUED)

PITCH ANGLE (DEG.)	YAW ANGLE= 0. DEG.	LIFT FORCE COEF.	DRAG FORCE COEF.	SIDE FORCE COEF.	PITCHING MOMENT COEF.	YAWING MOMENT COEF.	ROLLING MOMENT COEF.
-40.		-6.7	95.7	0.2	-179.1	8.4	-3.6
-35.		-8.9	88.6	0.7	-165.5	6.0	-3.9
-30.		-12.3	81.6	0.6	-164.9	4.7	-1.6
-25.		-16.4	73.1	1.6	-155.4	2.6	0.8
-20.		-18.3	65.8	1.1	-145.4	3.2	0.1
-16.		-19.0	59.6	0.7	-141.4	0.0	-0.7
-12.		-19.1	53.2	1.4	-137.2	3.4	-2.1
-8.		-19.4	46.9	1.4	-118.0	1.7	-0.2
-4.		-17.0	41.1	1.5	-112.5	3.2	0.2
0.		-17.4	36.6	1.5	-133.6	2.7	-0.1
4.		-16.4	32.7	1.9	-140.6	1.2	-0.5
8.		-13.0	33.5	2.3	-156.0	1.5	0.4
12.		-9.8	36.9	2.4	-152.0	0.4	1.5
16.		0.5	46.9	1.5	-148.5	2.0	3.2
20.		2.1	53.5	1.8	-145.5	5.5	1.7
25.		8.1	58.9	0.8	-98.9	5.5	0.1
30.		14.1	66.2	1.9	-66.1	2.6	-0.1
35.		18.5	77.5	1.9	-40.3	1.7	1.0
40.		22.2	86.6	0.6	-25.8	2.3	4.0

TABLE III.- D5 BULLDOZER / BLADE CONFIGURATION (CONTINUED)

YAW ANGLE= 8. DEG.

PITCH ANGLE (DEG.)	LIFT FORCE COEF.	DRAG FORCE COEF.	SIDE FORCE COEF.	PITCHING MOMENT COEF.	YAWING MOMENT COEF.	ROLLING MOMENT COEF.
-40.	-5.2	100.6	-0.7	-176.7	-8.5	18.0
-35.	-8.0	94.7	-1.1	-157.9	-8.7	15.8
-30.	-11.5	88.7	-0.3	-150.5	-14.1	19.9
-25.	-14.2	81.0	0.2	-146.2	-20.4	21.5
-20.	-15.7	72.7	1.9	-135.6	-26.3	20.5
-16.	-21.2	65.9	4.1	-134.6	-23.0	16.4
-12.	-22.7	59.9	5.1	-123.3	-24.2	9.1
-8.	-22.2	53.4	7.2	-122.1	-35.7	5.2
-4.	-21.7	48.6	7.2	-124.1	-35.0	5.5
0.	-19.5	43.6	8.5	-129.1	-37.3	8.7
4.	-17.4	39.2	9.2	-130.5	-41.5	9.4
8.	-11.3	40.0	10.1	-139.0	-45.5	14.0
12.	-6.3	42.3	9.4	-142.7	-35.7	11.4
16.	5.2	52.9	10.8	-151.1	-16.4	18.3
20.	5.0	56.9	12.2	-137.8	2.8	13.0
25.	10.8	62.2	9.1	-89.7	12.3	3.1
30.	16.4	70.4	5.4	-60.5	2.2	0.2
35.	20.0	78.6	1.9	-44.8	4.6	4.6
40.	22.5	87.0	-3.1	-34.8	6.7	11.1

TABLE III.- D5 BULLDOZER / BLADE CONFIGURATION (CONTINUED)

YAW ANGLE= 16. DEG.

PITCH ANGLE (DEG.)	LIFT FORCE COEF.	DRAG FORCE COEF.	SIDE FORCE COEF.	PITCHING MOMENT COEF.	YAWING MOMENT COEF.	ROLLING MOMENT COEF.
-40.	-7.2	106.4	-3.5	-175.0	-28.4	47.0
-35.	-7.9	101.1	1.5	-158.9	-30.2	42.3
-30.	-9.0	94.5	3.5	-150.1	-39.1	41.0
-25.	-14.4	88.4	3.9	-145.6	-44.7	30.8
-20.	-16.9	80.2	7.0	-140.4	-44.6	37.3
-16.	-22.1	74.4	7.3	-131.1	-36.2	29.4
-12.	-24.1	69.2	10.0	-124.8	-39.5	22.4
-8.	-23.6	64.3	10.2	-127.9	-46.2	18.2
-4.	-24.9	59.5	10.0	-125.0	-41.7	17.5
0.	-22.3	55.5	10.1	-116.5	-50.6	15.0
4.	-17.4	52.3	10.5	-124.4	-57.7	17.1
8.	-9.4	52.6	11.0	-132.5	-56.3	17.8
12.	-3.9	53.6	11.0	-135.9	-44.7	19.3
16.		61.6	12.1	-149.1	-14.7	27.0
20.	11.5	66.1	9.0	-149.6	3.7	28.6
25.	20.3	70.8	3.6	-112.5	15.0	21.0
30.	23.5	77.5	-0.6	-80.5	15.7	12.9
35.	23.7	84.7	-1.5	-64.7	20.8	14.1
40.	22.7	90.4	-3.1	-57.0	27.6	29.1

TABLE III.- D5 BULLDOZER / BLADE CONFIGURATION (CONTINUED)

YAW ANGLE= 30. DEG.

PITCH ANGLE (DEG.)	LIFT FORCE COEF.	DRAG FORCE COEF.	SIDE FORCE COEF.	PITCHING MOMENT COEF.	YAWING MOMENT COEF.	ROLLING MOMENT COEF.
-40.	-3.3	116.8	-0.2	-152.9	-48.0	65.3
-35.	-7.2	111.3	1.5	-153.1	-47.5	62.8
-30.	-9.6	103.8	2.4	-146.2	-51.0	62.7
-25.	-13.2	98.8	3.3	-141.1	-52.2	59.9
-20.	-18.9	93.9	4.8	-144.7	-49.9	59.1
-16.	-25.8	90.6	5.5	-142.0	-48.2	50.4
-12.	-26.0	86.6	7.6	-157.5	-44.4	50.9
-8.	-27.9	83.1	8.6	-166.6	-41.0	47.1
-4.	-30.2	79.6	9.4	-156.5	-28.4	35.0
0.	-28.2	76.0	9.6	-146.7	-23.1	29.7
4.	-22.2	72.8	11.6	-136.8	-12.7	26.0
8.	-11.8	70.1	13.3	-119.3	2.6	27.2
12.	-3.8	69.1	14.4	-109.0	16.2	29.8
16.		73.0	11.7	-142.6	18.1	44.7
20.	12.3	76.2	9.1	-135.8	30.5	57.5
25.	21.4	80.5	4.3	-113.0	36.8	63.3
30.	24.4	85.9	-0.8	-93.6	37.8	54.4
35.	24.2	90.2	-2.6	-76.4	40.4	47.2
40.	24.0	93.4	-5.3	-53.0	48.2	43.5
					48.1	37.0

TABLE III.- D5 BULLDOZER / BLADE CONFIGURATION (CONTINUED)

YAW ANGLE= 60. DEG.								
PITCH ANGLE (DEG.)	LIFT FORCE COEF.	DRAG FORCE COEF.	SIDE FORCE COEF.	PITCHING MOMENT COEF.	YAWING MOMENT COEF.	ROLLING MOMENT COEF.		
-40.	3.0	102.0	3.6	-111.7	-21.1	85.1		
-35.	1.3	100.8	4.1	-114.1	-17.8	92.9		
-30.	-2.1	97.9	6.1	-114.3	-13.0	91.8		
-25.	-4.8	94.8	5.6	-113.6	0.8	85.0		
-20.	-7.2	92.7	8.0	-109.7	9.0	78.5		
-16.	-9.4	90.5	9.7	-104.7	16.3	69.5		
-12.	-9.7	89.6	10.5	-104.6	21.4	71.4		
-8.	-9.2	87.6	12.5	-96.2	35.0	61.4		
-4.	-9.4	86.4	14.0	-89.3	43.7	54.0		
0.	-7.1	84.5	15.2	-79.4	50.1	45.3		
4.	-5.0	81.8	15.5	-72.6	54.2	38.7		
8.	-2.1	81.2	16.0	-63.9	60.7	30.7		
12.	2.0	80.4	15.9	-57.2	63.0	22.2		
16.						7.8		
20.						1.1		
25.						-4.6		
30.						-7.7		
35.						-7.8		
40.						-6.8		
						-8.8		

YAW ANGLE= 90. DEG.

-29-

TABLE IV.- D5 BULLDOZER REVERSE CONFIGURATION
YAW ANGLE= -90. DEG.

PITCH ANGLE (DEG.)	LIFT FORCE COEF.	DRAG FORCE COEF.	SIDE FORCE COEF.	PITCHING MOMENT COEF.	YAWING MOMENT COEF.	ROLLING MOMENT COEF.
-40.	8.0	63.6	-5.4	-56.9	-35.3	-6.8
-35.	6.2	64.0	-2.8	-52.7	-38.4	-14.9
-30.	7.8	64.2	-3.3	-50.7	-44.8	-10.2
-25.	8.4	64.0	-2.8	-45.0	-49.1	-8.9
-20.	8.7	64.0	-2.1	-40.7	-52.6	-9.9
-16.	8.3	64.0	-0.7	-36.8	-55.1	-11.5
-12.	10.2	64.2	-1.4	-31.6	-58.3	-6.1
-8.	8.1	64.8	0.6	-28.7	-59.7	-12.1
-4.	10.4	64.4	0.3	-23.4	-61.8	-5.9
0.	8.7	65.3	1.1	-19.9	-61.9	-10.6
4.	9.2	64.6	1.8	-15.2	-62.7	-15.2
8.	6.8	65.7	1.9	-11.2	-63.9	-13.4
12.	6.4	66.2	2.9	-6.6	-65.7	-8.8
16.	9.0	63.6	4.7	-2.8	-64.1	-9.9
20.	5.8	64.4	4.0	1.3	-66.7	-11.5
25.	7.3	64.0	4.7	8.4	-67.5	-16.2
30.	6.4	65.1	5.7	14.1	-68.0	-12.0
35.	6.9	64.7	8.0	20.2	-67.0	-12.2
40.	6.0	65.3	7.0	25.9	-65.7	-9.3
					-64.0	-13.2

TABLE IV.- D5 BULLDOZER REVERSE CONFIGURATION (CONTINUED)

YAW ANGLE= -60. DEG.

PITCH ANGLE (DEG.)	LIFT FORCE COEF.	DRAG FORCE COEF.	SIDE FORCE COEF.	PITCHING MOMENT COEF.	YAWING MOMENT COEF.	ROLLING MOMENT COEF.
-40.	-7.1	74.7	-18.5	-97.0	-64.6	11.3
-35.	-5.6	73.0	-19.8	-89.2	-74.4	11.7
-30.	-5.1	71.6	-20.3	-81.2	-82.8	9.8
-25.	-3.1	69.3	-20.9	-74.9	-89.8	6.1
-20.	-1.9	57.4	-19.9	-65.7	-94.9	4.5
-16.	0.4	65.9	-19.5	-58.4	-100.1	6.1
-12.	1.4	64.5	-18.7	-54.2	-104.8	2.9
-8.	1.3	64.2	-17.5	-51.1	-109.4	0.3
-4.	2.5	63.6	-16.8	-48.0	-115.1	0.4
0.	4.7	63.8	-16.8	-40.0	-121.7	2.9
4.	9.5	63.0	-15.9	-30.3	-129.1	8.6
8.	14.2	63.0	-15.3	-16.6	-133.9	14
12.	17.9	62.7	-13.9	-2.8	-136.1	19.1
16.	26.3	59.2	-11.0	12.1	-150.8	21.6
20.	28.8	59.9	-9.3	25.4	-151.7	27.0
25.	30.0	61.1	-7.4	39.3	-151.5	20.1
30.	30.8	62.8	-5.0	52.3	-146.6	33.3
35.	29.7	63.1	-3.4	51.2	-142.5	31.0
40.	29.3	64.7	-0.0	70.1	-135.8	28.5

TABLE IV.- D5 BULLDOZER REVERSE CONFIGURATION (CONTINUED)

PITCH ANGLE (DEG.)	LIFT FORCE COEF.	DRAG FORCE COEF.	SIDE FORCE COEF.	PITCHING MOMENT COEF.	YAWING MOMENT COEF.	ROLLING MOMENT COEF.
-40.	-21.0	71.1	-24.3	-116.5	-39.4	14.2
-35.	-21.4	67.9	-23.9	-112.5	-46.5	11.0
-30.	-21.3	63.4	-22.8	-110.3	-50.5	5.9
-25.	-21.3	59.3	-22.9	-105.7	-53.7	4.2
-20.	-20.6	55.6	-22.3	-102.6	-55.6	4.3
-16.	-23.	54.0	-22.2	-109.6	-59.2	7.6
-12.	-20	51.9	-21.7	-100.0	-60.9	11.5
-8.	-14.9	50.6	-22.3	-80.7	-62.7	16.1
-4.	-7.6	49.0	-21.6	-54.0	-64.0	21.0
0.	-2.2	48.0	-20.5	-32.5	-62.9	23.4
4.	3.2	48.1	-18.3	-12.7	-61.1	24.8
8.	8.2	48.8	-16.8	11.4	-61.7	28.1
12.	16.4	49.7	-13.7	42.4	-60.9	34.3
16.	26.9	51.7	-12.5	79.8	-67.8	41.2
20.	31.2	54.1	-10.4	102.0	-67.1	45.0
25.	46.6	55.6	-5.5	103.8	-65.6	39.7
30.	38.6	63.6	-8.5	145.1	-64.7	54.8
35.	41.8	62.9	-5.2	159.5	-57.6	58.1
40.	42.3	66.6	-1.9	157.2	-48.5	59.0
		69.3				

TABLE IV.- D5 BULLDOZER REVERSE CONFIGURATION (CONTINUED)

PITCH ANGLE (DEG.)	YAW ANGLE= 0. DEG.	LIFT FORCE COEF.	DRAG FORCE COEF.	SIDE FORCE COEF.	PITCHING MOMENT COEF.	YAWING MOMENT COEF.	ROLLING MOMENT COEF.
-40.	-15.5	44.0	-0.3	-85.0	-0.9	-2.1	
-35.	-15.4	41.2	0.5	-78.9	-1.7	-0.5	
-30.	-13.9	37.6	0.3	-66.8	-0.1	-2.2	
-25.	-11.4	33.8	0.0	-52.3	2.0	-2.4	
-20.	-8.7	30.0	0.6	-43.9	-1.3	-0.9	
-16.	-6.4	27.2	1.2	-37.5	-5.0	-1.1	
-12.	-6.7	25.4	1.6	-33.5	-3.7	0.0	2.0
-8.	-7.9	24.6	1.4	-33.7	-2.0	0.4	1.8
-4.	-6.1	23.2	1.7	-30.5	0.5	-0.6	1.5
0.	-3.3	23.0	1.5	-9.3	-0.3	-0.3	1.3
4.	0.6	23.0	1.2	7.0	-0.4	-0.4	1.2
8.	3.8	23.7	1.2	17.5	-0.2	-3.9	0.2
12.	8.0	25.1	1.3	35.6	0.9	-0.1	1.0
16.	17.7	28.6	-1.8	77.5		-0.8	1.2
20.	22.3	30.5	-1.9	101.6		-0.3	0.6
25.	25.9	34.8	-4.8	121.3		-12.2	-1.6
30.	27.9	38.2	-2.7	129.3		-4.5	-1.5
35.	33.9	44.5	-0.5	156.5		-0.4	-0.5
40.	41.1	54.3	-0.1	184.4		0.7	-0.3

TABLE IV.- D5 BULLDOZER REVERSE CONFIGURATION (CONTINUED)

PITCH ANGLE (DEG.)	YAW ANGLE= 4. DEG.	LIFT FORCE COEF.	DRAG FORCE COEF.	SIDE FORCE COEF.	PITCHING MOMENT COEF.	YAWING MOMENT COEF.	ROLLING MOMENT COEF.
-40.		-12.4	45.8	3.1	-87.0	8.9	-8.2
-35.		-13.6	43.8	4.1	-80.1	9.8	-7.5
-30.		-15.2	40.1	3.5	-68.8	5.3	-7.3
-25.		-13.0	37.0	3.4	-54.1	1.8	-5.5
-20.		-10.1	34.3	2.6	-43.8	-8.6	-4.3
-16.		-8.1	31.6	3.3	-35.8	-8.1	-4.2
-12.		-7.1	28.3	3.1	-31.3	-6.9	-2.8
-8.		-6.6	26.4	4.8	-31.9	-4.1	-2.9
-4.		-5.8	25.2	6.0	-23.6	-3.2	-3.3
0.		-3.1	24.7	5.0	-12.7	-1.7	-2.4
4.		0.6	24.8	4.9	3.2	3.5	-2.7
8.		4.6	25.4	6.1	16.0	4.6	-3.7
12.		8.6	26.8	6.0	39.7	3.3	-4.6
16.		12.3	27.4	4.5	51.0	4.7	-5.5
20.		18.3	29.3	4.1	80.7	4.7	-6.5
25.		21.8	32.1	4.2	101.0	3.1	-7.0
30.		26.5	35.3	2.1	118.9	-4.3	-4.8
35.		28.3	38.7	3.3	129.9	0.2	-5.5
40.		35.7	45.7	-2.9	158.6	-1.1	-8.0
		40.6	54.3	-4.8	180.2	-6.3	

TABLE IV.- D5 BULLDOZER REVERSE CONFIGURATION (CONTINUED)

YAW ANGLE= 8. DEG.

PITCH ANGLE (DEG.)	LIFT FORCE COEF.	DRAG FORCE COEF.	SIDE FORCE COEF.	PITCHING MOMENT COEF.	YAWING MOMENT COEF.	ROLLING MOMENT COEF.
-40.	-11.3	49.2	8.9	-86.2	17.8	-14.3
-35.	-15.0	47.2	10.7	-83.7	18.1	-13.1
-30.	-15.8	43.9	8.9	-75.5	15.2	-11.7
-25.	-14.2	40.5	7.6	-63.8	10.0	-9.8
-20.	-12.8	38.3	8.0	-51.5	-2.3	-7.6
-16.	-9.5	35.2	7.2	-36.7	-3.5	-5.8
-12.	-9.2	32.1	7.6	-34.2	-2.6	-5.8
-8.	-8.1	30.2	8.0	-27.3	-7.9	-5.9
-4.	-5.7	29.5	8.1	-19.3	-7.6	-4.7
0.	-2.1	28.5	8.2	-7.6	-4.3	-5.0
4.	2.3	28.4	8.4	4.5	0.9	-4.6
8.	6.0	29.0	9.1	22.6	2.1	-6.5
12.	10.4	30.0	9.2	44.7	5.5	-8.0
16.	17.9	32.5	8.1	69.2	5.8	-10.7
20.	21.4	34.8	6.4	91.8	4.4	-12.5
25.	27.4	38.5	6.0	123.0	5.3	-13.0
30.	31.8	43.2	3.6	142.9	9.9	-12.0
35.	37.3	48.9	-1.1	159.2	5.6	-12.6
40.	41.0	56.1	-8.1	179.1	-8.4	-10.7

TABLE IV.- D5 BULLDOZER REVERSE CONFIGURATION (CONTINUED)

YAW ANGLE= 16. DEG.

PITCH ANGLE (DEG.)	LIFT FORCE COEF.	DRAG FORCE COEF.	SIDE FORCE COEF.	PITCHING MOMENT COEF.	YAWING MOMENT COEF.	ROLLING MOMENT COEF.
-40.	-15.6	57.0	18.1	-100.5	24.8	-19.1
-35.	-16.7	55.4	19.8	-93.8	30.4	-19.9
-30.	-15.1	51.4	19.1	-80.2	27.7	-16.1
-25.	-14.6	48.0	16.8	-73.5	26.1	-13.8
-20.	-14.1	44.3	15.3	-61.2	20.1	-8.5
-16.	-12.7	42.0	14.6	-49.2	15.5	-6.9
-12.	-15.9	38.9	14.5	-59.5	7.4	-11.8
-8.	-12.8	37.2	14.1	-46.8	4.5	-14.0
-4.	-6.9	36.4	14.2	-34.0	7.0	-13.3
0.	-0.7	36.4	13.7	-11.9	10.7	-13.0
4.	4.3	37.2	13.4	3.4	11.6	-13.2
8.	10.8	38.3	13.0	27.8	16.5	-14.2
12.	15.1	39.7	12.1	50.5	23.2	-16.8
16.		40.5	12.8	75.8	25.8	-20.4
20.		43.9	13.7	102.8	37.3	-24.5
25.		47.9	11.6	129.8	38.8	-25.1
30.		52.0	9.4	150.9	36.4	-26.0
35.		56.4	4.3	163.8	30.4	-27.2
40.		60.4	-2.4	165.2	16.0	-32.1

TABLE IV.- D5 BULLDOZER REVERSE CONFIGURATION (CONTINUED)

PITCH ANGLF (DEG.)	LIFT FORCE COEF.	DRAG FORCE COEF.	SIDE FORCE COEF.	PITCHING MOMENT COEF.	YAWING MOMENT COEF.	ROLLING MOMENT COEF.
-40.	-19.3	71.7	25.6	-116.3	39.5	-18.9
-35.	-21.0	68.5	24.2	-112.8	44.0	-12.0
-30.	-20.2	64.0	24.3	-113.5	47.0	-6.5
-25.	-20.0	59.5	22.9	-107.3	51.0	-4.4
-20.	-20.6	56.9	23.4	-107.9	55.2	-5.5
-16.	-21.2	55.0	22.8	-110.4	57.4	-8.1
-12.	-18.3	53.7	23.4	-101.1	59.6	-12.9
-8.	-13.8	51.4	23.4	-84.2	62.5	-15.8
-4.	-7.7	50.0	23.0	-60.1	65.9	-19.8
0.	-2.3	49.2	22.2	-41.6	65.4	-20.7
4.	4.9	49.8	20.9	-17.6	66.9	-22.1
8.	11.2	49.9	18.8	12.3	63.9	-24.9
12.	17.0	51.4	16.3	42.3	68.0	-30.6
16.	28.5	53.9	13.3	84.4	67.1	-40.5
20.	32.5	56.1	12.1	106.2	67.2	-44.0
25.	36.8	59.9	10.6	127.7	68.3	-48.4
30.	42.3	65.2	8.8	153.8	65.4	-54.9
35.	44.9	69.1	6.2	165.5	61.7	-54.7
40.	42.0	70.0	2.1	151.8	48.5	-52.4

TABLE IV.- D5 BULLDOZER REVERSE CONFIGURATION (CONTINUED)

YAW ANGLE= 45. DEG.

PITCH ANGLE (DEG.)	LIFT FORCE COEF.	DRAG FORCE COEF.	SIDE FORCE COEF.	PITCHING MOMENT COEF.	YAWING MOMENT COEF.	ROLLING MOMENT COEF.
-40.	-14.2	78.7	24.3	-124.6	59.3	-14.9
-35.	-14.0	75.9	24.6	-119.1	68.7	-8.3
-30.	-12.7	73.0	25.3	-113.3	80.5	-5.6
-25.	-12.8	70.3	25.5	-110.0	87.3	0.6
-20.	-11.9	67.5	24.0	-103.9	90.6	5.7
-16.	-12.1	65.8	23.3	-100.2	96.1	6.0
-12.	-8.7	63.8	24.0	-92.7	101.8	2.9
-8.	-4.8	63.1	23.6	-84.9	106.7	0.2
-4.	-0.7	62.4	23.0	-76.9	110.2	-2.7
0.	4.6	62.4	22.7	-63.5	115.6	-7.0
4.	9.4	62.1	21.6	-41.3	118.4	-14.2
8.	13.4	62.2	19.9	-20.6	121.2	-24.2
12.	18.8	61.8	17.1	4.8	121.4	-31.8
16.	27.0	61.0	11.4	37.3	119.6	-44.6
20.	30.6	60.8	9.0	60.1	115.0	-50.7
25.	32.2	63.1	7.4	82.5	107.0	-56.0
30.	33.5	65.1	5.6	101.8	99.6	-59.1
35.	37.7	68.5	1.9	112.2	90.8	-58.2
40.	34.7	70.1	1.1	121.9	86.6	-55.0

TABLE IV.- D5 BULLDOZER REVERSE CONFIGURATION (CONTINUED)

PITCH ANGLE (DEG.)	YAW ANGLE= 60. DEG.		SIDE FORCE COEF.		PITCHING MOMENT COEF.	YAWING MOMENT COEF.		ROLLING MOMENT COEF.
	LIFT FORCE COEF.	DRAG FORCE COEF.						
-40.	-5.1	75.7	20.2		-97.0	65.9		-8.0
-35.	-3.1	73.7	21.3		-90.5	77.7		-7.4
-30.	-0.8	71.6	22.5		-83.0	85.8		-4.9
-25.	0.0	70.5	21.8		-75.6	93.9		-3.5
-20.	2.5	68.4	21.4		-67.8	97.7		0.6
-15.	2.8	67.2	20.5		-62.0	101.8		2.1
-12.	4.5	65.4	19.2	16.7	-58.3	108.5	109.1	4.6
-8.	6.1	64.8	18.9	16.7	-51.9	111.6	117.4	4.8
-4.	7.3	63.9	17.6	16.9	-48.1	119.0	126.0	3.6
0.	10.4	64.3	17.2	16.3	-38.9	128.0	133.0	-1.1
4.	13.5	64.4	15.8	15.3	-30.7	131.7	137.6	-6.8
8.	17.5	64.3	14.9	15.0	-18.8	138.4	143.7	-11.7
12.	21.3	64.8	13.8	13.8	-5.3	141.7	146.2	-15.5
16.	25.9	60.7	12.1	12.8		149.5	149.5	-22.2
20.	28.0	62.4	10.8	10.8	12.8	150.0	150.0	-28.0
25.	28.5	63.0	10.5	10.5	24.8	146.8	146.8	-29.2
30.	28.3	64.6	8.8	8.8	36.4	142.6	142.6	-31.6
35.	28.4	64.8	5.2	5.2	49.5	138.3	138.3	-28.7
40.	28.8	65.9	1.9	1.9	58.9	127.6	127.6	-30.1

TABLE IV.- D5 BULLDOZER REVERSE CONFIGURATION (CONTINUED)

YAW ANGLE= 75. DEG.								
PITCH ANGLE (DEG.)	LIFT FORCE COEF.	DRAG FORCE COEF.	SIDE FORCE COEF.	PITCHING MOMENT COEF.	YAWING MOMENT COEF.	POLLING MOMENT COEF.		
-40.	3.9	67.3	19.0	-75.2	64.7	-10.8		
-35.	5.7	66.7	19.1	-68.6	71.9	-10.8		
-30.	6.5	65.0	18.1	-61.7	76.7	-7.5		
-25.	7.6	64.2	17.9	-54.3	81.8	-7.3		
-20.	8.8	64.3	17.1	-49.2	88.6	-8.0		
-15.	9.9	63.6	17.2	-42.5	89.8	-6.0		
-12.	10.8	62.8	16.3	-38.1	95.2	-5.7		-6.3
-8.	11.6	62.7	15.5	-31.6	100.0	-5.0		-6.7
-4.	12.9	62.6	14.0	-24.9	101.1	-2.8		-7.7
0.	12.7	62.5	13.3	-19.0	105.6	-1.0		-6.0
4.	12.9	61.3	12.1	-12.6	105.0	-0.0		-5.8
8.	13.2	60.0	10.5	-8.2	103.8	0.1		-4.1
12.	13.8	60.4	9.3	0.2	105.7	1.2		-5.8
16.			8.9					-4.0
20.			7.0	6.6	112.4			-2.1
25.			6.0	11.0	113.5			-0.5
30.			5.2	20.5	116.1			0.7
35.			3.0	29.0	112.8			5.0
40.			1.6	38.0	112.2			7.1
			0.7	46.3	108.0			

TABLE IV.- D5 BULLDOZER REVERSE CONFIGURATION (CONTINUED)

YAW ANGLE= 90. DEG.

PITCH ANGLE (DEG.)	LIFT FORCE COEF.	DRAW FORCE COEF.	SIDE FORCE COEF.	PITCHING MOMENT COEF.	YAWING MOMENT COEF.	ROLLING MOMENT COEF.
-40.	3.4	63.6	2.2	-55.4	35.8	26.3
-35.	6.0	63.6	3.0	-51.8	40.6	22.8
-30.	6.8	63.3	3.2	-47.6	43.0	22.3
-25.	8.4	63.3	2.5	-42.9	49.6	20.2
-20.	6.5	62.9	0.5	-38.8	52.4	21.9
-16.	9.4	63.6	1.7	-34.7	54.4	15.8
-12.	7.6	64.1	0.0	-30.2	56.7	20.6
-8.	7.9	64.2	0.2	-25.9	58.2	15.7
-4.	7.4	64.5	-0.0	-22.9	60.1	18.1
0.	7.7	64.4	-0.6	-16.8	62.8	17.7
4.	7.7	65.4	-1.0	-13.3	65.6	18.0
8.	5.6	64.1	-1.2	-7.3	62.9	18.2
12.	7.0	64.2	-2.3	-2.9	63.1	17.3
16.		62.8	-4.1	-0.7	65.9	16.0
20.		62.4	-4.1	5.1	68.3	16.9
25.		63.3	-5.1	9.8	66.4	10.4
30.		64.2	-2.4	15.6	66.2	13.7
35.		63.9	-4.8	23.6	65.9	10.0
40.		64.6	-2.7	26.7	62.1	12.7
						7.5

TABLE IV.- D5 BULLDOZER REVERSE CONFIGURATION (CONCLUDED)

YAW ANGLE= 95. DEG.

PITCH ANGLE (DEG.)	LIFT FORCE COEF.	DRAG FORCE COEF.	SIDE FORCE COEF.	PITCHING MOMENT COEF.	YAWING MOMENT COEF.	PULLING MOMENT COEF.
-40.	4.4	64.4	-4.3	-46.4	20.1	28.8
-35.	3.9	65.3	-5.7	-44.2	23.8	30.1
-30.	4.8	65.5	-4.6	-42.0	30.2	28.5
-25.	2.8	65.1	-6.1	-38.9	33.2	28.4
-20.	2.8	64.5	-4.8	-35.8	37.1	27.7
-16.	4.1	66.5	-5.9	-33.3	40.4	26.7
-12.	2.7	65.7	-6.5	-29.6	42.4	26.8
-8.	3.0	65.2	-6.1	-26.0	44.3	25.6
-4.	1.9	66.5	-5.5	-23.1	47.8	25.7
0.	2.6	66.6	-5.4	-18.6	51.9	23.4
4.	2.4	66.6	-6.0	-15.1	51.3	24.2
8.	3.2	68.1	-5.8	-11.1	55.0	20.2
12.	3.5	66.2	-5.9	-7.8	54.2	21.7
16.			-8.5	-3.7	56.0	15.8
20.			-7.3	1.3	59.1	20.0
25.			-9.0	7.1	60.7	15.3
30.			-8.3	12.9	61.0	17.7
35.			-9.8	19.0	59.7	15.8
40.			-8.8	24.2	56.8	17.6

TABLE V.- M109 FORWARD CONFIGURATION

YAW ANGLE = -90. DEG.

PITCH ANGLE (DEG.)	LIFT FORCE COEF.	DRAW FORCE COEF.	SIDE FORCE COEF.	PITCHING MOMENT COEF.	YAWING MOMENT COEF.	ROLLING MOMENT COEF.
-40.	-1.8	134.4	-6.8	-101.1	-63.2	30.0
-35.	-0.5	134.4	-6.3	-97.5	-72.5	18.6
-30.	2.3	132.3	-8.2	-83.7	-80.0	20.1
-25.	2.7	132.2	-7.8	-76.5	-84.4	26.3
-20.	-0.9	132.7	-3.9	-71.3	-90.5	20.0
-16.	7.0	130.2	-6.8	-55.9	-37.1	23.0
-12.	5.6	131.2	-6.7	-49.5	-97.4	26.0
-8.	7.0	133.1	-4.6	-43.8	-104.5	22.9
-4.	8.1	134.2	-4.2	-30.5	-110.9	24.5
0.	13.5	132.2	-5.7	-25.0	-110.9	32.4
4.	10.1	134.4	-4.6	-19.1	-110.2	32.3
8.	5.9	134.2	-3.2	-9.6	-108.0	31.5
12.	6.6	134.7	-0.8	2.1	-105.2	23.6
16.	10.1	132.2	-4.5	-9.1	-115.0	23.0
20.	10.3	129.5	-3.6	6.9	-111.9	19.3
25.	8.0	131.8	-4.0	15.0	-114.9	22.1
30.	8.4	132.6	-3.1	26.8	-119.5	17.7
35.	7.6	130.8	-0.1	40.6	-107.1	3.8
40.	13.1	135.1	5.4	58.7	-110.8	15.7

TABLE V.- M109 FORWARD CONFIGURATION (CONTINUED)

YAW ANGLE = -60. DEG.

PITCH ANGLE (DEG.)	LIFT FORCE COEF.	DRAW FORCE COEF.	SIDE FORCE COEF.	PITCHING MOMENT COEF.	YAWING MOMENT COEF.	ROLLING MOMENT COEF.
-40.	-45.5	166.7	-21.3	-382.3	-80.7	-146.1
-35.	-39.7	164.7	-43.6	-377.0	-118.4	-134.4
-30.	-35.9	157.6	-47.6	-361.3	-152.2	-128.8
-25.	-30.3	151.3	-51.1	-329.9	-184.0	-113.7
-20.	-27.0	147.4	-53.3	-305.5	-212.0	-103.4
-16.	-29.3	145.3	-50.0	-275.6	-237.8	-85.8
-12.	-28.1	141.9	-52.3	-257.6	-257.7	-66.4
-8.	-26.1	139.1	-53.5	-223.4	-274.7	-24.8
-4.	-18.7	136.3	-53.8	-192.4	-290.5	1.0
0.	-12.2	135.0	-55.2	-174.6	-315.7	31.7
4.	-6.9	131.6	-53.6	-135.4	-321.1	64.8
8.	2.8	132.2	-52.9	-85.1	-328.2	113.5
12.	15.2	132.7	-51.1	-29.9	-334.7	168.6
16.	27.0	139.2	-49.6	13.3	-348.8	229.8
20.	34.0	137.7	-43.7	60.4	-347.3	264.0
25.	43.5	140.6	-34.7	129.4	-337.5	309.8
30.	55.2	145.1	-24.1	193.7	-327.7	342.0
35.	61.0	149.2	-10.0	244.3	-311.4	354.0
40.	64.3	151.0	5.4	282.1	-283.2	360.6

TABLE V.- M109 FORWARD CONFIGURATION (CONTINUED)

YAW ANGLE = -30. DEG.

PITCH ANGLE (DEG.)	LIFT FORCE COEF.	DRAG FORCE COEF.	SIDE FORCE COEF.	PITCHING MOMENT COEF.	YAWING MOMENT COEF.	ROLLING MOMENT COEF.
-40.	-119.0	176.5	-9.2	-767.8	95.6	-187.7
-35.	-116.8	163.0	-25.5	-758.7	45.9	-164.1
-30.	-111.8	148.5	-36.6	-735.0	5.2	-141.4
-25.	-107.9	133.0	-43.1	-707.5	-51.0	-114.7
-20.	-100.0	120.6	-53.9	-673.2	-132.0	-84.3
-16.	-87.2	110.4	-58.4	-600.5	-183.6	-51.7
-12.	-76.1	100.7	-58.3	-543.6	-200.7	-24.3
-8.	-50.5	88.7	-61.9	-432.3	-214.2	27.3
-4.	-29.3	83.5	-64.4	-338.6	-234.1	51.2
0.	-0.4	79.4	-61.4	-181.1	-244.7	91.3
4.	17.5	80.0	-56.4	-56.5	-235.0	111.4
8.	40.8	83.9	-52.8	80.9	-228.7	138.8
12.	61.4	90.2	-45.8	225.8	-216.8	177.6
16.	89.6	103.1	-41.2	364.0	-235.0	215.8
20.	110.6	113.7	-32.5	514.8	-237.6	239.4
25.	130.3	131.8	-19.4	619.2	-218.4	239.7
30.	145.8	149.9	-6.9	714.8	-192.2	248.4
35.	156.1	166.1	6.4	788.8	-168.2	261.8
40.	155.8	178.5	18.9	822.8	-136.0	267.2

TABLE V.- M109 FORWARD CONFIGURATION (CONTINUED)

PITCH ANGLE (DEG.)	YAW ANGLE=	0.	DEG.	LIFT FORCE COEF.	DRAW FORCE COEF.	SIDE FORCE COEF.	PITCHING MOMENT COEF.	YAWING MOMENT COEF.	ROLLING MOMENT COEF.
-40.	-147.3	156.3	3.4	-908.3	9.6	6.8			
-35.	-130.3	130.4	4.6	-818.8	7.5	-1.6			
-30.	-118.0	110.0	7.2	-741.0	19.0	-2.0			
-25.	-112.9	92.4	6.5	-710.4	14.2	-12.8			
-20.	-99.4	71.4	7.3	-683.2	19.0	-9.0			
-16.	-82.2	58.1	7.7	-610.5	18.4	-10.0			
-12.	-64.8	47.7	5.6	-518.0	19.3	-5.4			
-8.	-44.8	40.0	8.4	-409.9	19.8	-7.6			
-4.	-26.7	36.2	6.5	-286.3	19.1	-5.8			
0.	-8.7	35.2	5.4	-151.7	20.2	-2.1			
4.	8.0	34.3	4.6	-30.8	16.4	-2.6			
8.	24.0	36.9	3.8	112.0	12.8	1.0			
12.	37.9	43.3	3.5	237.2	9.3	0.1			
16.		66.1		372.0		-5.0			
20.		76.9		460.9		-6.0			
25.		89.3		571.4		-1.2			
30.		102.1		655.5		-3.8			
35.		116.8		736.3		-0.5			
40.		137.3		831.1		5.0			

TABLE V.- M109 FORWARD CONFIGURATION (CONTINUED)

YAW ANGLE= 4. DEG.

PITCH ANGLE (DEG.)	LIFT FORCE COEF.	DRAG FORCE COEF.	SIDE FORCE COEF.	PITCHING MOMENT COEF.	YAWING MOMENT COEF.	ROLLING MOMENT COEF.
-40.	-144.1	158.1	3.7	-906.9	-32.3	40.8
-35.	-129.9	135.1	14.1	-817.4	-24.5	15.9
-30.	-119.8	113.6	15.5	-745.6	19.7	3.9
-25.	-111.6	94.1	15.9	-700.0	22.6	-6.2
-20.	-100.8	74.7	16.3	-689.6	30.0	-21.8
-16.	-81.3	60.1	15.3	-613.1	41.7	-18.0
-12.	-64.0	50.0	15.1	-511.9	45.9	-19.0
-8.	-47.0	43.1	15.4	-413.5	52.3	-16.2
-4.	-25.3	38.8	15.8	-286.9	49.6	-13.3
0.	-7.2	37.0	13.8	-160.1	50.8	-10.5
4.	10.7	37.4	13.9	-14.0	54.4	-11.0
8.	30.0	40.8	12.4	136.6	45.6	-15.0
12.	42.0	46.6	10.9	250.0	42.6	-14.6
16.	67.8	59.6	8.7	382.7	32.9	-17.0
20.	76.4	70.9	8.3	470.6	33.7	-10.8
25.	91.8	90.2	5.8	590.4	27.6	-7.1
30.	104.5	112.1	-1.5	674.5	13.6	-0.6
35.	121.7	135.6	-10.5	758.6	-23.6	-13.2
40.	139.6	163.7	-20.5	852.0	-20.2	-24.6

TABLE V.- M109 FORWARD CONFIGURATION (CONTINUED)

PITCH ANGLE (DEG.)	YAW ANGLE= 8. DEG.	LIFT FORCE COEF.	DRAW FORCE COEF.	SIDE FORCE COEF.	PITCHING MOMENT COEF.	YAWING MOMENT COEF.	ROLLING MOMENT COEF.
-40.		-134.4	159.4	11.2	-859.1	-64.9	53.0
-35.		-131.9	139.3	19.7	-823.8	-48.3	32.8
-30.		-121.9	119.1	22.4	-762.1	7.3	9.9
-25.		-112.7	98.7	26.9	-732.6	24.9	-6.9
-20.		-102.7	79.1	25.7	-692.9	49.8	-27.3
-16.		-85.4	64.6	24.4	-626.3	60.9	-30.2
-12.		-68.4	54.5	25.9	-537.3	77.0	-28.8
-8.		-45.7	48.1	25.9	-416.0	79.7	-25.6
-4.		-27.2	43.2	24.9	-294.0	87.5	-22.9
0.		-9.6	41.5	25.1	-156.8	94.5	-12.3
4.		9.6	41.5	23.7	-15.5	98.5	-18.0
8.		28.9	44.1	22.0	125.3	86.2	-28.8
12.		45.5	49.9	21.4	261.2	82.8	-31.6
16.		71.7	51.3	18.8	394.8	75.6	-23.8
20.		85.6	63.1	17.4	508.4	73.6	-23.0
25.		97.6	76.1	16.0	609.0	77.4	-12.1
30.		111.9	93.5	10.0	705.1	60.0	-14.3
35.		138.3	114.3	-1.0	816.5	28.3	-20.9
40.		148.1	139.6	-20.4	866.8	-31.2	-38.4
			163.7	-33.1		-45.7	-52.9

TABLE V.- M109 FORWARD CONFIGURATION (CONTINUED)

YAW ANGLE= 16. DEG.

PITCH ANGLE (DEG.)	LIFT FORCE COEF.	LRAG FORCE COEF.	SIDE FORCE COEF.	PITCHING MOMENT COEF.	YAWING MOMENT COEF.	ROLLING MOMENT COEF.
-40.	-131.2	166.4	7.1	-833.0	-86.1	101.9
-35.	-128.5	150.2	20.1	-832.6	-60.0	70.8
-30.	-121.7	132.3	32.9	-798.8	-1.4	31.7
-25.	-110.3	114.0	38.8	-740.7	34.9	14.5
-20.	-114.4	94.9	41.0	-789.0	58.0	-19.4
-16.	-90.0	79.3	44.9	-670.5	109.6	-40.7
-12.	-72.6	68.9	45.8	-571.9	127.8	-38.0
-8.	-54.6	62.8	42.8	-449.7	143.9	-32.0
-4.	-28.6	58.2	42.6	-300.0	154.8	-37.9
0.	-9.3	55.7	42.0	-175.1	163.6	-44.3
4.	10.6	54.5	39.0	-36.1	169.6	-53.6
8.	30.4	57.1	37.3	121.5	158.2	-71.0
12.	52.9	63.3	35.5	265.9	162.0	-74.6
16.		75.3	30.4	424.7	159.4	-85.6
20.		88.4	23.2	541.8	153.3	-70.2
25.		108.3	9.7	689.1	105.5	-87.0
30.		127.4	-5.9	807.3	54.3	-102.6
35.		149.8	-21.3	860.6	19.2	-103.0
40.		168.6	-33.8	897.1	1.2	-111.5

TABLE V.- M109 FORWARD CONFIGURATION (CONTINUED)

YAW ANGLE= 30° DEG.

PITCH ANGLE (DEG.)	LIFT FORCE COEF.	DRAW FORCE COEF.	SIDE FORCE COEF.	PITCHING MOMENT COEF.	YAWING MOMENT COEF.	ROLLING MOMENT COEF.
-40.	-117.6	177.9	12.7	-761.7	-84.3	183.7
-35.	-123.6	169.8	27.3	-779.6	-26.7	164.9
-30.	-114.9	153.8	41.5	-759.2	20.0	143.6
-25.	-110.3	138.6	46.0	-714.5	66.5	114.3
-20.	-99.5	124.9	55.9	-667.6	132.8	94.7
-16.	-90.3	117.0	61.2	-604.8	194.7	60.2
-12.	-78.2	108.8	62.7	-522.0	224.3	26.1
-8.	-59.1	100.4	63.2	-434.7	243.0	-5.8
-4.	-37.8	93.6	63.3	-332.6	260.1	-34.9
0.	-17.1	89.3	63.3	-212.9	265.8	-58.2
4.	10.7	87.4	59.8	-69.6	261.8	-94.7
8.	36.9	87.6	54.2	66.5	252.2	-124.0
12.	64.0	95.3	51.4	212.5	246.7	-165.5
16.	92.4	102.2	42.7	384.2	230.9	-201.8
20.	114.5	114.5	33.0	508.4	226.2	-223.8
25.	133.6	133.0	19.2	618.1	197.9	-236.3
30.	144.8	149.0	5.1	722.6	178.3	-251.9
35.	153.7	164.0	-5.6	809.2	154.5	-271.3
40.	158.4	178.3	-23.8	839.4	130.1	-285.0

TABLE V.- M109 FORWARD CONFIGURATION (CONTINUED)

YAW ANGLE= 45. DEG.

PITCH ANGLE (DEG.)	LIFT FORCE COEF.	DRAG FORCE COEF.	SIDE FORCE COEF.	PITCHING MOMENT COEF.	YAWING MOMENT COEF.	ROLLING MOMENT COEF.
-40.	-79.5	178.0	22.7	-535.7	0.1	160.0
-35.	-80.3	171.4	33.1	-551.3	45.3	160.5
-30.	-78.3	163.2	43.4	-546.0	87.2	151.8
-25.	-71.8	156.3	53.6	-528.7	128.6	155.8
-20.	-56.5	147.7	62.0	-489.6	161.3	142.0
-16.	-50.0	139.1	62.5	-437.3	193.8	108.3
-12.	-45.6	136.3	67.0	-395.4	231.8	78.6
-8.	-36.1	131.6	69.0	-350.0	262.1	45.4
-4.	-21.6	124.5	67.0	-280.8	279.5	4.4
0.	-5.5	120.6	65.1	-213.6	286.2	-29.5
4.	6.2	121.1	62.4	-132.4	301.1	-87.9
8.	23.9	121.5	59.7	-52.2	320.1	-131.7
12.	30.7	124.4	57.1	31.6	322.3	-107.2
16.	56.7	128.1	50.3	177.7	304.2	-285.0
20.	70.6	129.6	39.1	284.8	292.8	-32.7
25.	88.6	136.6	25.9	400.9	272.3	-259.8
30.	105.9	146.9	11.9	491.5	247.9	-382.6
35.	111.9	156.2	0.7	549.0	219.4	-301.0
40.	117.3	169.9	-12.5	597.0	199.0	-301.1

TABLE V.- M109 FORWARD CONFIGURATION (CONTINUED)

YAW ANGLE= 60. DEG.

PITCH ANGLE (DEG.)	LIFT FORCE COEF.	DRAW FORCE COEF.	SIDE FORCE COEF.	PITCHING MOMENT COEF.	YAWING MOMENT COEF.	ROLLING MOMENT COEF.
-40.	-41.7	170.4	29.3	-392.1	69.8	134.5
-35.	-41.4	168.4	36.7	-407.6	121.4	141.9
-30.	-40.5	164.6	39.3	-388.4	157.0	134.1
-25.	-37.9	159.6	42.7	-362.2	192.3	133.0
-20.	-32.9	153.3	45.8	-321.6	216.5	115.2
-16.	-30.6	152.3	48.3	-301.1	239.3	102.7
-12.	-28.8	146.5	48.7	-271.6	254.6	88.7
-8.	-32.7	145.7	50.0	-264.6	273.5	58.6
-4.	-21.6	141.4	52.2	-243.7	291.5	41.3
0.	-16.8	139.7	52.8	-217.1	312.0	13.4
4.	-24.3	140.2	53.7	-199.5	322.5	-36.7
8.	-26.5	141.3	56.1	-157.7	331.2	-85.1
12.	-15.1	141.4	55.5	-101.7	338.1	-137.3
16.	17.2	140.2	48.3	-7.5	334.3	-210.4
20.	27.4	138.1	41.1	45.7	330.1	-251.0
25.	39.7	139.7	32.6	107.8	324.9	-284.0
30.	49.6	142.2	23.6	171.4	317.5	-337.1
35.	55.4	148.2	12.1	225.0	301.9	-364.4
40.	62.9	148.5	-2.0	271.1	282.1	-389.4

TABLE V.- M109 FORWARD CONFIGURATION (CONTINUED)

YAW ANGLE= 75. DEG.

PITCH ANGLE (DEG.)	LIFT FORCE COEF.	DRAG FORCE COEF.	SIDE FORCE COEF.	PITCHING MOMENT COEF.	YAWING MOMENT COEF.	ROLLING MOMENT COEF.
-40.	-13.5	155.7	13.0	-234.1	107.9	97.0
-35.	-12.8	157.3	19.8	-228.7	131.6	91.1
-30.	-9.8	154.9	26.2	-220.7	147.2	83.2
-25.	-11.5	155.6	26.4	-216.9	176.6	80.3
-20.	-11.4	154.3	29.1	-206.9	192.2	76.6
-16.	-7.5	149.4	27.8	-192.7	201.3	71.9
-12.	-7.1	145.9	28.4	-179.5	209.4	65.8
-8.	-4.4	146.8	30.4	-164.1	227.9	59.7
-4.	-9.1	146.1	28.3	-150.3	236.8	50.1
0.	-2.6	144.7	30.6	-128.4	242.7	45.0
4.	-3.7	140.7	30.0	-115.1	248.1	32.6
8.	-1.6	141.0	29.8	-89.1	262.4	30.6
12.	-0.7	139.6	30.7	-69.1	262.1	18.3
16.	-22.1	139.4	36.4	-88.3	287.1	20.0
20.	-19.1	136.9	36.0	-62.6	287.4	20.0
25.	-14.6	136.3	34.8	-35.1	286.6	20.0
30.	-12.5	139.1	36.2	-9.7	280.8	20.0
35.	-7.3	137.7	35.2	20.1	281.8	20.0
40.	-4.3	136.9	31.7	44.6	281.0	20.0

TABLE V.- M109 FORWARD CONFIGURATION (CONTINUED)

YAW ANGLE= 90. DEG.

PITCH ANGLE (DEG.)	LIFT FORCE COEF.	DRAG FORCE COEF.	SIDE FORCE COEF.	PITCHING MOMENT COEF.	YAWING MOMENT COEF.	ROLLING MOMENT COEF.
-40.	-15.2	145.9	-11.2	-144.0	48.3	-14.5
-35.	-19.5	146.5	-11.6	-140.1	48.4	-23.2
-30.	-12.1	142.3	-5.1	-122.7	66.9	-27.5
-25.	-8.2	140.1	-1.2	-111.3	76.0	-27.3
-20.	-9.0	137.7	-0.2	-103.9	87.7	-30.3
-15.	-1.5	138.0	3.6	-91.8	88.6	-28.5
-12.	-2.7	134.6	3.1	-79.2	99.0	78.6
-8.	0.1	137.5	3.7	-75.2	99.4	89.9
-4.	3.8	134.8	4.9	-61.7	108.9	84.7
0.	6.8	134.4	4.9	-45.8	110.1	107.9
4.	8.1	133.9	4.4	-37.0	114.2	116.7
8.	10.8	134.6	4.0	-27.2	116.0	115.7
12.	5.4	135.7	3.1	-19.7	114.1	101.3
16.	-11.1	135.7		-51.5	140.7	140.7
20.	-0.6	133.1		-40.2	107.7	107.7
25.	-7.1	134.5		-33.3	131.0	131.0
30.	-4.7	133.2		-14.9	100.8	100.8
35.	-2.2	134.2		-5.7	130.0	130.0
40.	-8.9	136.3		5.4	137.8	137.8

TABLE V.- M109 FORWARD CONFIGURATION (CONCLUDED)

PITCH ANGLE (DEG.)	YAW ANGLE= 95. DEG.	LIFT FORCE COEF.	DRAW FORCE COEF.	SIDE FORCE COEF.	PITCHING MOMENT COEF.	YAWING MOMENT COEF.	ROLLING MOMENT COEF.
-40.		-26.5	143.1	-21.1	-142.1	2.9	-62.8
-35.		-26.7	142.9	-19.9	-134.6	15.8	-63.1
-30.		-21.2	142.1	-11.4	-133.4	28.4	-60.1
-25.		-4.1	144.6	-4.4	-121.0	40.8	21.4
-20.		-15.0	141.2	-6.9	-114.8	48.5	-47.0
-16.		-19.6	140.9	-8.7	-107.2	54.5	-63.3
-12.	8.1	-0.5	134.4	-3.1	-79.4	61.5	-45.7
-8.	-8.5	-1.5	135.6	-0.7	-82.0	67.6	-55.1
-4.	-14.0	6.1	134.6	0.0	-71.6	75.5	-53.0
0.	-9.6	10.0	135.0	-3.1	-55.4	73.2	-45.7
4.	-7.8	9.9	135.2	-4.3	-42.1	72.9	-38.0
8.	8.5	1.7	137.2	-3.5	-50.7	90.7	-53.0
12.	15.4	3.8	137.5	-4.2	-44.0	83.7	-30.0
16.	14.1		130.2	-7.1	-33.6	73.0	-30.7
20.	18.3		131.0	-10.5	-24.5	80.2	-37.6
25.	16.2		132.7	-11.4	-16.1	80.2	-38.8
30.	18.2		134.4	-14.5	0.1	78.6	-10.7
35.	20.2		132.6	-19.3	14.0	77.7	-17.5
40.	17.0		137.8	-18.5	24.7	87.2	-17.0

TABLE VI.- M109 REVERSE CONFIGURATION

YAW ANGLE = -90. DEG.

PITCH ANGLE (DEG.)	LIFT FORCE COEF.	DRAG FORCE COEF.	SIDE FORCE COEF.	PITCHING MOMENT COEF.	YAWING MOMENT COEF.	ROLLING MOMENT COEF.
-40.	2.7	133.6	-12.9	59.0	174.1	15.9
-35.	-3.8	133.6	-7.9	43.7	180.5	39.4
-30.	2.0	133.9	-9.5	31.3	187.9	15.9
-25.	5.4	134.5	-10.9	20.2	183.3	17.3
-20.	3.4	133.7	-10.0	-1.9	188.0	30.4
-16.	3.0	132.8	-7.0	-10.4	191.1	27.5
-12.	-0.7	133.7	-8.3	-24.0	189.7	67.0
-8.	-0.1	134.2	-8.0	-34.4	184.4	45.5
-4.	2.2	133.7	-7.8	-46.7	181.2	52.1
0.	5.2	133.3	-7.7	-59.0	178.1	58.6
4.	9.7	132.8	-6.4	-69.4	159.4	57.0
8.	1.4	133.6	-6.2	-81.4	167.4	56.6
12.	5.4	136.9	-5.5	-88.8	156.4	66.4
16.	10.2	128.4	-7.7	-117.2	146.2	12.0
20.	12.3	132.7	-4.1	-120.7	141.7	-22.2
25.	3.0	132.8	-9.6	-147.6	130.3	-2.4
30.	13.2	129.6	-4.4	-143.4	109.7	-3.4
35.	12.7	130.3	-1.3	-156.4	106.4	-2.7
40.	10.9	133.9	-3.1	-158.1	96.6	-2.1

TABLE VI.- M109 REVERSE CONFIGURATION (CONTINUED)

YAW ANGLE = -60. DEG.						
PITCH ANGLE (DEG.)	LIFT FORCE COEF.	DRAW FORCE COEF.	SIDE FORCE COEF.	PITCHING MOMENT COEF.	YAWING MOMENT COEF.	ROLLING MOMENT COEF.
-40.	-25.6	156.8	-26.7	-51.6	96.2	72.1
-35.	-21.6	151.6	-29.4	-58.9	79.2	48.8
-30.	-17.4	149.0	-35.1	-63.7	65.6	29.2
-25.	-10.5	144.0	-35.9	-63.2	55.7	8.4
-20.	-5.3	138.0	-32.6	-69.0	48.0	-15.1
-16.	1.5	136.6	-32.1	-60.1	43.9	-11.4
-12.	-6.0	132.8	-26.0	-69.9	30.1	-8.4
-8.	-7.0	129.8	-26.7	-80.7	22.0	8.8
-4.	-4.3	125.7	-22.2	-89.2	14.8	15.6
0.	-3.2	125.3	-21.0	-91.7	11.8	38.8
4.	1.9	124.7	-19.6	-86.2	7.2	57.6
8.	6.3	125.6	-18.2	-82.6	-3.0	75.0
12.	9.1	126.5	-13.8	-84.9	-7.4	100.0
16.	20.3	126.5	-18.0	-86.7	-77.0	145.0
20.	27.5	130.7	-16.5	-74.4	-87.5	193.8
25.	23.6	134.7	-18.5	-111.1	-127.4	151.0
30.	27.0	138.0	-11.6	-107.4	-151.2	100.0
35.	30.4	143.3	-5.9	-111.8	-142.7	110.8
40.	35.3	147.0	7.7	-109.7	-160.0	60.0

TABLE VI.- M109 REVERSE CONFIGURATION (CONTINUED)

YAW ANGLE= -30. DEG.

PITCH ANGLE (DEG.)	LIFT FORCE COEF.	DRAW FORCE COEF.	SIDE FORCE COEF.	PITCHING MOMENT COEF.	YAWING MOMENT COEF.	ROLLING MOMENT COEF.
-40.	-82.0	175.8	-33.2	34.2	107.1	204.8
-35.	-75.1	160.4	-37.3	20.9	87.3	193.9
-30.	-62.1	145.1	-40.4	23.7	70.6	180.4
-25.	-57.9	136.9	-40.4	2.6	58.4	182.1
-20.	-43.0	123.5	-34.3	19.2	51.6	174.0
-16.	-33.7	115.4	-29.9	42.7	59.6	160.8
-12.	-28.1	108.9	-15.1	41.0	73.9	133.9
-8.	-19.5	103.1	-9.0	46.2	95.3	110.1
-4.	-16.3	100.8	-8.7	-5.7	92.3	72.1
0.	-1.9	98.6	-4.5	-11.5	86.0	51.3
4.	16.1	98.6	-2.2	-7.3	77.3	34.5
8.	33.3	104.6	-0.7	-18.7	57.9	23.9
12.	33.6	110.8	-0.5	-21.6	22.8	31.3
16.	50.0	117.2	-0.1	-7.1	-5.6	43.2
20.	55.0	124.1	-2.3	13.6	-30.8	45.1
25.	61.7	135.0	-3.6	43.4	-31.7	40.4
30.	67.9	144.3	-1.9	73.4	-22.6	45.2
35.	77.1	155.5	7.8	84.1	-20.2	45.2
40.	79.4	163.5	17.7	81.8	-15.3	40.1

YAW ANGLE= 0. DEG.

PITCH ANGLE (DEG.)	LIFT FORCE COEF.	DRAW FORCE COEF.	SIDE FORCE COEF.	PITCHING MOMENT COEF.	YAWING MOMENT COEF.	ROLLING MOMENT COEF.
-40.	-74.1	134.5	-3.6	136.7	7.1	-8.7
-35.	-67.2	118.6	2.0	134.3	25.4	3.7
-30.	-52.0	105.2	3.1	133.3	18.7	15.7
-25.	-43.0	94.8	5.1	148.5	0.4	8.7
-20.	-31.9	85.6	0.0	175.4	-7.8	0.5
-16.	-27.4	79.7	0.3	187.0	-12.4	1.6
-12.	-20.2	71.5	0.9	215.0	-4.8	1.4
-8.	-23.3	65.7	1.1	235.0	-5.2	1.1
-4.	-12.6	62.0	2.6	208.3	1.5	0.9
0.	-5.2	67.9	1.3	103.5	-10.7	1.0
4.	4.9	66.9	2.8	-58.7	-18.3	4.2
8.	10.3	71.6	3.9	-59.7	-3.2	-0.6
12.	21.9	57.0	4.9	-13.1	1.5	-1.5
16.	25.1	90.0	1.8	74.4	-2.4	-0.7
20.	35.0	99.4	1.2	104.2	-7.8	-1.1
25.	49.1	112.3	-1.6	127.6	-0.2	-1.7
30.	56.9	126.4	-1.4	137.2	-2.5	-1.9
35.	71.4	147.7	1.6	102.2	-5.2	-2.4
40.	78.5	166.8	0.5	118.1	-0.8	-1.1

TABLE VI.- M109 REVERSE CONFIGURATION (CONTINUED)

PITCH ANGLE (DEG.)	YAW ANGLE= 4. DEG.	LIFT FORCE COEF.	DRAW FORCE COEF.	SIDE FORCE COEF.	PITCHING MOMENT COEF.	YAWING MOMENT COEF.	ROLLING MOMENT COEF.
-40.		-67.1	127.1	10.9	134.1	-17.6	-32.9
-35.		-59.4	116.6	9.9	128.4	-44.3	-29.1
-30.		-53.2	107.8	7.6	132.8	-46.6	-31.6
-25.		-43.2	97.3	6.8	144.9	-45.7	-33.2
-20.		-31.7	86.6	6.3	162.9	-36.0	-33.1
-16.		-25.0	79.4	7.7	183.1	-32.7	-25.8
-12.		-18.4	74.3	6.4	217.6	-30.2	-26.0
-8.		-16.6	68.6	4.9	203.9	-39.7	-26.2
-4.		-5.9	65.5	6.4	173.2	-58.1	-21.5
0.		-2.5	65.7	5.3	95.5	-65.6	-8.1
4.		6.7	70.0	3.2	-35.7	-60.0	9.8
8.		17.7	71.5	7.8	-27.8	-38.8	4.7
12.		22.0	78.0	8.8	-1.5	-27.9	-0.9
16.		28.0	83.3	8.2	11.1	-30.5	-13.5
20.		40.3	91.3	11.0	56.6	-20.2	-20.5
25.		34.0	102.1	8.9	92.4	-16.6	-23.2
30.		57.1	105.7	8.0	170.1	-2.2	-21.6
35.		69.3	126.1	7.8	133.3	11.3	-11.5
40.		82.0	144.7	-2.5	113.3	15.6	7.1
			164.1	-16.1	148.6	13.8	22.2

TABLE VI.- M109 REVERSE CONFIGURATION (CONTINUED)

PITCH ANGLE (DEG.)	YAW ANGLE= 8. DEG.	LIFT FORCE COEF.	DRAW FORCE COEF.	SIDE FORCE COEF.	PITCHING MOMENT COEF.	YAWING MOMENT COEF.	ROLLING MOMENT COEF.
-40.		-74.2	136.9	15.5	125.2	-70.5	-68.7
-35.		-64.3	124.2	16.1	127.0	-63.8	-62.1
-30.		-53.3	110.1	16.0	132.1	-60.5	-58.5
-25.		-42.2	100.3	17.4	143.7	-70.6	-55.3
-20.		-34.0	90.8	14.5	165.9	-58.4	-57.2
-16.		-23.4	83.0	14.2	176.9	-47.7	-56.3
-12.	-4.2	-14.2	76.8	14.8	205.6	-42.9	-41.0
-8.	1.5	-8.9	73.2	10.4	191.5	-77.4	-53.5
-4.	3.0	-5.0	71.3	7.3	156.8	-94.5	-40.0
0.	14.9	2.1	69.2	5.0	80.6	-83.3	-17.7
4.	3.5	8.8	71.3	3.9	8.2	-74.2	5.4
8.	15.8	15.8	78.6	7.0	-72.9	-61.2	10.2
12.	25.7	25.7	84.7	0.0	-48.6	-41.1	17.2
16.	42.3	42.3	98.4	6.0	-4.9	-26.0	11.7
20.	43.7	43.7	105.1	11.0	74.8	-27.5	5.2
25.	54.9	54.9	116.8	8.4	114.0	-13.4	-32.8
30.	66.8	66.8	133.1	6.0	118.0	8.6	-30.8
35.	76.3	76.3	148.4	-7.7	137.9	23.6	-18.4
40.	82.7	82.7	162.7	-20.5	170.0	8.4	5.1
							5.2

TABLE VI.- M109 REVERSE CONFIGURATION (CONTINUED)

YAW ANGLE= 16. DEG.

PITCH ANGLE (DEG.)	LIFT FORCE COEF.	DRAG FORCE COEF.	SIDE FORCE COEF.	PITCHING MOMENT COEF.	YAWING MOMENT COEF.	ROLLING MOMENT COEF.
-40.	-77.8	148.4	25.6	91.0	-84.2	-128.9
-35.	-71.6	138.8	30.2	101.0	-83.6	-122.7
-30.	-60.1	125.9	30.8	92.5	-80.1	-113.1
-25.	-43.3	113.6	34.8	97.5	-89.7	-96.0
-20.	-29.8	103.5	33.7	106.3	-61.9	-86.2
-16.	-17.2	94.6	30.9	124.1	-45.6	-84.9
-12.	-3.4	89.7	26.1	142.0	-76.5	-75.8
-8.	-0.3	85.2	15.7	116.6	-107.7	-66.2
-4.	-8.3	81.9	9.9	75.3	-107.3	-43.7
0.	3.1	81.7	8.1	13.2	-110.8	-11.4
4.	9.1	84.7	5.9	-61.6	-113.9	19.2
8.	16.3	88.4	11.6	-72.6	-73.0	24.9
12.	28.1	94.5	9.7	-53.8	-71.5	26.4
16.	55.3	108.8	3.9	-20.8	-39.9	35.2
20.	67.1	118.0	13.1	57.6	1.2	-35.2
25.	74.4	131.1	10.9	101.3	0.0	-42.2
30.	78.7	141.2	3.4	130.9	14.0	-38.2
35.	82.3	153.1	-6.0	141.6	10.4	-21.7
40.	85.4	167.3	-19.0	155.1	-4.8	-1.2

TABLE VI.- M109 REVERSE CONFIGURATION (CONTINUED)

PITCH ANGLE (DEG.)	YAW ANGLE= 30. DEG.		SIDE FORCE COEF.	PITCHING MOMENT COEF.	YAWING MOMENT COEF.	ROLLING MOMENT COEF.
	LIFT FORCE COEF.	DRAW FORCE COEF.				
-40.	-74.2	170.7	32.0	15.8	-136.1	-160.1
-35.	-61.3	157.0	39.2	-6.8	-130.2	-136.5
-30.	-50.5	146.1	40.6	-6.1	-113.2	-127.6
-25.	-46.4	136.8	38.1	-22.4	-82.8	-133.2
-20.	-37.2	127.4	32.3	-7.4	-78.6	-122.4
-16.	-23.7	119.1	28.1	4.3	-80.8	-110.1
-12.	-23.1	114.5	17.9	17.6	-101.2	-97.2
-8.	-19.5	107.6	15.2	12.4	-100.9	-81.3
-4.	-12.9	105.2	18.1	-39.0	-93.3	-53.6
0.	-0.3	103.7	14.6	-42.3	-89.9	-34.6
4.	15.9	105.3	11.5	-32.8	-89.0	-13.8
8.	1.3	108.3	10.7	16.1	-69.8	-37.7
12.	25.7	115.1	5.8	-0.2	-45.8	-44.1
16.	48.0	121.1	9.1	4.8	9.0	-52.6
20.	57.3	130.8	9.3	32.3	20.7	-54.1
25.	61.0	139.2	9.1	58.1	21.6	-54.0
30.	69.4	148.3	1.0	82.9	16.8	-60.2
35.	73.6	158.5	-2.2	94.8	10.7	-57.7
40.	77.5	167.8	-14.2	93.8	17.7	-58.0

TABLE VI.- M109 REVERSE CONFIGURATION (CONTINUED)

YAW ANGLE= 45. DEG.

PITCH ANGLE (DEG.)	LIFT FORCE COEF.	DRAG FORCE COEF.	SIDE FORCE COEF.	PITCHING MOMENT COEF.	YAWING MOMENT COEF.	ROLLING MOMENT COEF.
-40.	-59.2	173.8	27.3	-53.0	-132.0	-121.3
-35.	-48.3	166.5	32.2	-76.7	-114.5	-100.5
-30.	-41.1	156.8	33.6	-95.5	-89.4	-82.6
-25.	-38.6	148.5	31.4	-104.3	-74.3	-61.2
-20.	-37.7	141.5	27.2	-102.6	-71.2	-46.2
-16.	-33.6	135.4	24.1	-93.5	-67.4	-47.2
-12.	-24.1	131.2	24.0	-95.7	-60.1	-50.2
-8.	-9.1	127.7	26.2	-84.5	-50.3	-37.1
-4.	4.2	123.6	24.1	-66.6	-35.4	-41.7
0.	11.6	121.9	21.5	-46.5	-29.9	-66.1
4.	20.9	122.5	18.9	-34.7	-14.3	-92.5
8.	33.0	126.4	15.6	-14.7	-7.2	-110.4
12.	36.1	129.4	10.7	6.1	11.0	-123.3
16.	47.6	132.7	9.5	-9.8	40.3	-124.7
20.	54.7	141.5	8.9	0.5	59.6	-132.0
25.	55.6	147.0	3.6	-0.2	62.1	-113.4
30.	57.2	152.4	1.3	-8.5	73.1	-94.7
35.	58.1	160.1	-3.8	9.0	63.8	-84.0
40.	60.1	168.1	-12.5	-3.6	54.5	-55.7

TABLE VI.- M109 REVERSE CONFIGURATION (CONTINUED)

PITCH ANGLE (DEG.)	YAW ANGLE= 60. DEG.	LIFT FORCE COEF.	DRAG FORCE COEF.	SIDE FORCE COEF.	PITCHING MOMENT COEF.	YAWING MOMENT COEF.	ROLLING MOMENT COEF.
-40.		-14.4	161.8	35.7	-30.8	-99.4	-45.5
-35.		-19.8	160.0	33.6	-52.3	-83.2	1.8
-30.		-11.2	152.7	37.3	-60.4	-80.9	25.3
-25.		-8.6	147.1	37.7	-67.7	-72.0	41.9
-20.		-8.6	147.8	37.0	-70.6	-59.4	43.5
-16.		-9.9	141.2	31.9	-70.8	-49.1	37.3
-12.		-13.4	138.7	29.6	-89.2	-40.6	14.2
-8.		-9.4	137.5	31.4	-93.4	-30.0	0.6
-4.		-7.0	132.8	28.5	-98.3	-14.8	-16.7
0.		-1.9	133.9	28.4	-96.8	-11.2	-45.8
4.		3.4	133.3	25.1	-99.6	20.5	-82.7
8.		6.9	132.0	25.5	-94.6	39.6	-124.6
12.		14.4	135.7	25.1	-86.2	55.7	-140.4
16.		24.9		22.6	-79.5	73.5	-139.0
20.		24.2		23.2	-82.0	96.3	-200.0
25.		30.9		18.3	-78.7	120.1	-182.4
30.		33.6		15.2	-91.1	140.4	-142.5
35.		30.7		10.1	-89.8	145.5	-121.0
40.		38.3		-0.8	-98.6	148.7	-70.7

TABLE VI.- M109 REVERSE CONFIGURATION (CONTINUED)

YAW ANGLE= 75. DEG.

PITCH ANGLE (DEG.)	LIFT FORCE COEF.	DRAG FORCE COEF.	SIDE FORCE COEF.	PITCHING MOMENT COEF.	YAWING MOMENT COEF.	ROLLING MOMENT COEF.
-40.	9.2	145.0	38.0	22.7	-76.2	21.6
-35.	9.3	144.9	36.6	10.8	-74.2	13.7
-30.	11.8	141.3	34.8	3.2	-76.2	15.5
-25.	14.0	141.6	32.6	-4.5	-63.6	22.9
-20.	19.1	142.0	31.7	-6.7	-62.7	12.1
-16.	17.0	139.7	31.4	-22.3	-55.5	11.5
-12.	16.7	140.1	28.5	-23.5	-52.3	9.9
-8.	19.4	137.8	26.3	-29.2	-44.2	11.2
-4.	16.3	140.3	26.6	-43.2	-34.3	6.9
0.	12.8	137.0	23.3	-55.9	-27.8	16.7
4.	8.6	135.9	22.0	-62.3	-12.1	-15.3
8.	7.3	132.0	21.6	-69.9	-10.1	-24.0
12.	3.5	133.8	22.3	-85.7	6.8	-40.3
16.						
20.						
25.						
30.						
35.						
40.						

TABLE VI.- M109 REVERSE CONFIGURATION (CONTINUED)

PITCH ANGLE (DEG.)	YAW ANGLE= 90. DEG.	LIFT FORCE COEF.	DRAW FORCE COEF.	SIDE FORCE COEF.	PITCHING MOMENT COEF.	YAWING MOMENT COEF.	ROLLING MOMENT COEF.
-40.		-2.5	138.2	5.2	77.5	-173.3	-18.4
-35.		-1.9	136.5	6.3	65.4	-171.8	-13.3
-30.		-6.2	137.0	4.8	48.2	-179.3	-34.4
-25.		-3.3	137.8	3.3	37.1	-190.2	-30.4
-20.		-5.5	135.6	5.1	17.3	-177.0	-36.9
-16.		-0.3	137.0	5.4	9.7	-186.1	-29.2
-12.		0.1	136.5	5.7	-4.6	-187.9	-42.5
-8.		-0.1	135.1	5.9	-18.2	-186.6	-47.5
-4.		-1.7	135.8	4.3	-27.8	-180.3	-42.3
0.		5.2	137.7	3.5	-39.7	-191.2	-47.0
4.		-4.4	138.7	5.4	-56.4	-190.5	-45.8
8.		-1.9	139.6	5.6	-68.8	-180.6	-42.8
12.		-2.1	139.4	6.1	-84.4	-184.6	-42.1
16.		3.7	130.0	7.1	-99.6	-179.5	-18.0
20.		-2.6	130.5	11.1	-109.5	-135.9	-25.0
25.		-1.1	130.8	10.6	-116.5	-125.8	-10.3
30.		-0.3	131.4	10.7	-128.7	-123.0	-22.2
35.		2.8	132.0	8.3	-137.0	-110.5	-27.0
40.		11.0	132.0	-0.5	-132.0	-106.3	12.2

TABLE VI.- M109 REVERSE CONFIGURATION (CONCLUDED)

YAW ANGLE= 95. DEG.						
PITCH ANGLE (DEG.)	LIFT FORCE COEF.	DRAG FORCE COEF.	SIDE FORCE COEF.	PITCHING MOMENT COEF.	YAWING MOMENT COEF.	ROLLING MOMENT COEF.
-40.	-19.2	146.0	-20.9	55.8	-254.6	5.9
-35.	-7.9	145.1	-14.9	54.0	-253.2	14.3
-30.	-17.4	145.8	-18.4	26.7	-260.0	-1.4
-25.	-14.0	143.8	-15.7	13.5	-249.4	-5.5
-20.	3.8	141.0	-11.5	18.7	-250.1	9.8
-16.	-1.8	143.5	-12.9	-6.7	-252.4	-3.9
-12.	4.6	140.5	-13.2	-17.2	-249.2	2.4
-8.	5.0	144.3	-13.2	-30.7	-244.8	-1.8
-4.	1.5	140.3	-12.9	-41.5	-242.4	-20.1
0.	1.1	145.4	-14.9	-68.0	-235.0	-16.1
4.	2.3	145.9	-17.8	-77.3	-231.8	-22.6
8.	-1.6	144.5	-11.6	-104.9	-225.5	-31.8
12.	-0.9	145.2	-12.4	-106.5	-223.8	-32.8
16.	10.4	139.7	-17.1	-102.9	-217.4	43.0
20.	7.0	142.3	-16.0	-129.5	-207.9	31.0
25.	10.2	142.0	-17.6	-141.0	-194.2	20.0
30.	5.9	143.3	-15.5	-159.8	-172.6	30.0
35.	6.6	140.8	-17.0	-161.3	-144.1	24.6
40.	5.5	142.5	-16.0	-181.4	-148.8	2.0

TABLE VII.- M109 FORWARD CONFIGURATION WITH MACHINE GUN

PITCH ANGLE (DEG.)	LIFT FORCE		DRAG FORCE		SIDE FORCE		PITCHING MOMENT		YAWING MOMENT		ROLLING MOMENT	
	COEF.	DELTA	COEF.	DELTA	COEF.	DELTA	COEF.	DELTA	COEF.	DELTA	COEF.	DELTA
	YAW ANGLE= 0. DEG.											
-12.	-51.5	0.1	45.7	-0.1	3.3	0.2	-473.9	7.7	0.8	-2.7	4.6	2.3
-8.	-36.5	-1.2	39.1	0.3	2.9	1.6	-381.9	-8.9	4.3	-0.4	1.4	0.3
-4.	-17.7	-0.0	35.1	0.0	3.1	0.9	-247.5	10.3	4.8	1.3	-0.8	1.0
0.	-0.8	-1.5	34.2	0.7	2.5	0.1	-129.0	-7.8	6.0	-0.5	-1.1	-1.2
4.	15.4	-1.0	33.6	0.4	1.0	0.0	3.6	4.4	-0.7	-3.6	1.0	1.9
8.	31.8	-1.2	37.9	1.0	-0.1	-0.5	135.6	3.3	2.2	-2.5	1.1	1.9
12.	48.2	-2.3	47.0	1.0	0.5	0.9	259.4	-0.0	3.5	0.0	0.0	1.6
16.	63.2	-2.6	57.9	-0.4	0.5	2.0	367.1	-4.9	-2.3	2.7	-0.4	4.5
20.	75.5	-1.4	69.6	-0.2	-2.6	-0.0	465.5	4.6	-5.1	4.1	-5.4	1.5
25.	86.8	-2.4	88.0	-1.1	-2.2	-0.0	564.3	-7.1	-1.0	2.2	2.2	3.4
30.	98.6	-3.5	107.8	-2.9	-2.1	-1.6	656.6	1.0	-1.7	1.3	6.2	10.1
35.	116.3	-0.4	134.8	-1.3	-2.	-0.2	744.6	8.2	-2.4	7.0	9.6	4.7
40.	136.4	-0.9	162.6	-2.2	-4.7	-5.6	850.9	19.8	4.3	-1.6	15.4	8.0
	YAW ANGLE= 90. DEG.											
-12.	-28.4	-3.5	141.7	6.7	-2.3	0.0	-126.9	-7.4	93.1	14.4	-38.9	2.6
-8.	-27.8	-1.4	142.6	6.1	-1.0	-0.4	-117.0	-0.3	97.7	7.8	-40.8	5.2
-4.	-26.6	-12.9	139.7	5.8	1.1	-1.9	-109.0	-7.6	106.4	11.6	-33.7	1.8
0.	-26.6	2.9	140.5	3.0	4.8	-0.0	-97.6	2.3	104.8	-3.1	-28.5	10.5
4.	-20.1	4.5	137.6	-0.3	4.7	0.3	-86.3	5.9	107.8	-8.9	-38.5	1.9
8.	-23.5	-8.9	138.8	5.4	6.1	0.2	-76.0	0.1	121.9	6.5	-38.0	8.2
12.	-23.3	-4.0	139.0	1.3	8.7	2.4	-68.0	2.9	126.3	5.9	-24.3	23.0
16.	-22.5	-11.3	142.8	7.0	10.6	5.4	-56.1	-4.5	132.7	1.9	-20.9	11.2
20.	-17.6	-17.0	137.5	4.3	9.3	6.4	-44.3	-4.1	128.8	1.0	-28.1	17.8
25.	-15.1	-8.0	136.6	2.1	10.2	3.9	-32.5	0.7	129.5	-4.4	-24.3	11.0
30.	-14.1	-9.4	135.3	2.1	11.9	7.1	-15.4	-0.4	126.5	-3.2	-8.4	14.7
35.	-11.4	-9.2	133.7	-0.4	11.6	8.2	0.4	6.2	131.0	-3.0	-12.1	28.7
40.	-18.4	-9.5	138.9	2.6	18.0	8.4	13.2	7.3	134.5	-2.3	-7.4	17.2

TABLE VIII.- REYNOLDS NO. = .9 X 10**6 DATA

PITCH ANGLE (DEG.)	LIFT FORCE		DRAG FORCE		SIDE FORCE		PITCHING MOMENT		YAWING MOMENT		ROLLING MOMENT	
	COEF.	DELTA	COEF.	DELTA	COEF.	DELTA	COEF.	DELTA	COEF.	DELTA	COEF.	DELTA
D5 BULLDOZER FORWARD CONFIGURATION												
YAW ANGLE= 0. DEG.												
-12.	-13.5	0.1	25.4	1.0	0.3	0.8	5.7	2.4	2.2	-3.8	1.4	0.7
-8.	-10.3	-0.7	23.3	0.2	-0.3	-0.2	13.0	2.8	4.3	-4.7	1.2	0.5
-4.	-5.8	-0.8	22.5	0.3	-0.7	-0.5	19.0	0.8	3.5	0.0	1.1	0.4
0.	-0.3	-1.6	22.6	1.3	-0.6	0.5	27.4	2.5	8.8	-0.0	1.8	-0.3
4.	4.6	0.4	23.8	2.6	0.6	0.8	28.5	1.0	8.0	1.3	0.0	0.7
8.	7.2	-0.5	24.5	2.4	0.5	0.9	40.6	5.5	3.7	1.5	1.6	1.3
12.	11.8	-0.7	26.2	2.4	0.1	0.1	41.7	2.0	4.7	2.9	2.6	2.2
16.	16.5	-2.0	28.6	2.4	1.0	1.0	39.4	0.3	2.7	0.2	1.6	-0.3
20.	21.9	-2.3	31.6	1.8	-0.6	-2.2	39.5	1.2	-2.3	-7.6	2.1	-0.4
25.	28.5	1.8	35.9	2.1	0.4	0.5	36.7	-7.6	1.0	-0.2	2.4	1.0
30.	32.3	-1.2	43.1	-1.1	1.0	0.7	31.1	0.9	-0.1	1.2	1.9	-0.6
35.	36.9	-1.2	50.8	1.8	2.2	0.0	26.5	0.0	2.1	-1.7	-1.0	4.0
40.	39.8	0.0	57.5	-0.4	2.4	1.0	15.1	7.0	1.1	-0.8	-1.1	0.5

YAW ANGLE= 0. DEG.

D5 BULLDOZER/BLADE CONFIGURATION

PITCH ANGLE (DEG.)	LIFT FORCE		DRAG FORCE		SIDE FORCE		PITCHING MOMENT		YAWING MOMENT		ROLLING MOMENT	
	COEF.	DELTA	COEF.	DELTA	COEF.	DELTA	COEF.	DELTA	COEF.	DELTA	COEF.	DELTA
D5 BULLDOZER/BLADE CONFIGURATION												
YAW ANGLE= 0. DEG.												
-12.	-13.8	1.2	50.7	1.4	0.2	-1.4	-131.1	-0.9	6.8	4.0	0.8	2.2
-8.	-13.3	1.4	45.6	1.7	-0.3	-2.9	-116.5	-0.7	8.2	2.4	1.1	0.8
-4.	-12.5	1.1	39.8	1.6	0.5	-1.3	-120.2	1.9	5.0	0.0	1.6	1.8
0.	-14.2	-0.2	35.5	1.0	0.7	-0.5	-141.3	1.6	6.4	1.3	1.0	1.1
4.	-11.5	-0.4	34.2	1.4	0.6	-1.2	-156.3	1.6	9.5	6.0	1.2	0.6
8.	-7.1	0.2	36.5	0.8	-0.8	-2.9	-167.9	-0.7	9.2	7.6	1.1	0.6
12.	-4.5	-1.3	43.8	4.0	-2.4	-4.8	-180.4	-20.7	8.6	7.9	2.4	0.7
16.	0.6	0.1	51.6	4.7	-0.2	-1.8	-161.1	-12.5	11.9	9.4	3.7	0.5
20.	2.2	0.1	55.0	1.5	-0.6	-2.4	-140.7	4.8	6.9	1.3	2.5	0.5
25.	8.3	0.2	60.3	1.4	0.7	-0.1	-97.7	1.1	5.8	0.2	2.0	0.8
30.	13.2	-0.9	67.2	1.0	-0.0	-2.0	-66.0	0.0	1.8	-0.7	3.2	3.4
35.	18.0	-0.5	77.4	-0.0	-0.2	-2.2	-35.6	4.6	1.4	-0.7	2.7	1.7
40.	20.4	-1.8	85.4	-0.1	0.0	-0.6	-27.9	-2.1	1.5	-0.7	3.8	-1.1

TABLE VIII.- REYNOLDS NU. = .9 X 10**6 DATA (CONCLUDED)

PITCH ANGLF (DEG.)	LIFT FORCE		DRAG FORCE		SIDE FORCE		PITCHING MOMENT		YAWING MOMENT		ROLLING MOMENT	
	COEF.	DELTA	COEF.	DELTA	COEF.	DELTA	COEF.	DELTA	COEF.	DELTA	COEF.	DELTA
	YAW ANGLE= 0. DEG.											
	M109 FORWARD CONFIGURATION											
-12.	-47.2	4.5	42.3	-3.6	1.8	-1.3	-473.8	7.8	8.7	5.1	2.8	0.5
-8.	-30.0	5.3	36.8	-1.9	-0.3	-1.6	-377.8	-4.7	13.7	8.9	0.9	-0.1
-4.	-14.4	3.2	33.3	-1.7	-0.8	-3.0	-261.6	-3.8	14.3	8.1	0.7	2.6
0.	2.7	1.9	32.3	-1.1	-1.4	-3.8	-144.7	-23.5	12.6	6.1	0.8	0.7
4.	20.3	3.8	33.3	0.1	-1.9	-2.9	-16.1	-15.4	11.1	8.1	1.5	2.5
8.	37.6	4.5	33.2	1.3	-2.9	-3.3	111.1	-21.2	13.5	8.8	1.7	2.5
12.	53.2	2.6	47.2	1.2	-3.8	-3.4	237.8	-21.6	2.5	-1.0	1.3	3.0
16.	66.5	0.4	58.9	0.5	-4.8	-3.3	354.5	-17.5	-0.2	4.9	0.7	5.7
20.	80.3	3.3	71.6	1.7	-7.4	-4.8	444.4	-16.4	-1.6	7.6	-6.9	0.0
25.	91.7	2.3	89.4	0.2	-8.5	-6.3	549.5	-21.9	8.8	12.0	1.7	3.0
30.	104.3	2.2	111.0	0.1	-5.1	-4.5	632.2	-23.3	2.7	5.8	1.2	5.1
35.	119.6	2.8	138.8	2.6	-6.6	-4.7	717.5	-13.7	7.1	16.6	5.7	0.8
40.	138.1	0.7	167.4	2.5	-2.7	-3.6	815.5	-15.5	16.7	10.7	12.2	4.9

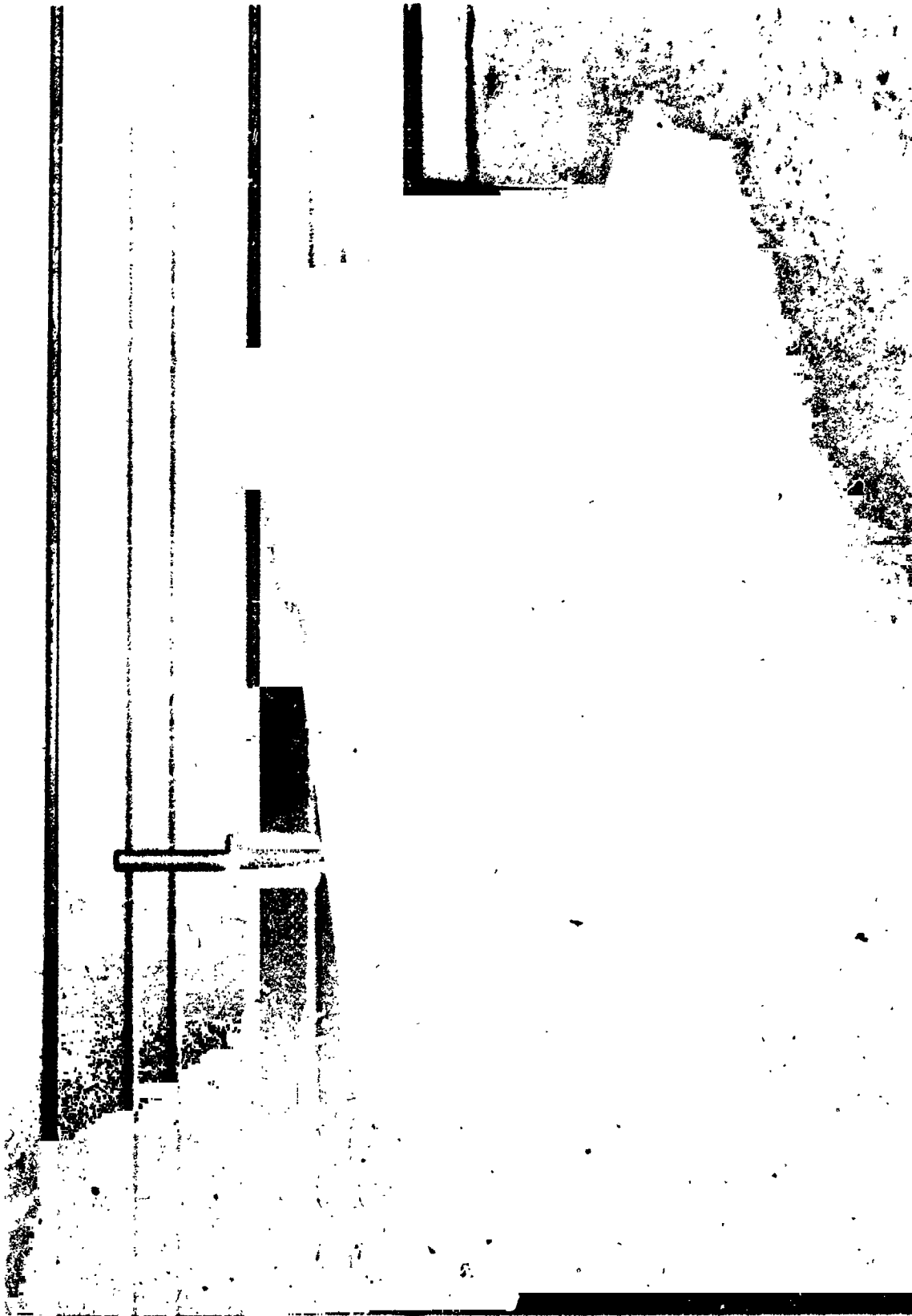
TABLE IX.- M109 FORWARD CONFIGURATION DATA REPEATABILITY CHECK

PITCH ANGLE (DEG.)	LIFT FORCE		DRAG FORCE		SIDE FORCE		PITCHING MOMENT		YAWING MOMENT		ROLLING MOMENT	
	COEF.	DELTA	COEF.	DELTA	COEF.	DELTA	COEF.	DELTA	COEF.	DELTA	COEF.	DELTA
	YAW ANGLE= 0. DEG.											
-12.	-52.0	-0.2	46.2	0.3	2.5	-0.5	-477.1	4.5	4.6	1.1	1.1	-1.1
-8.	-35.8	-0.4	38.7	-0.0	2.6	1.3	-374.3	-1.2	4.3	-0.4	1.1	0.0
-4.	-17.7	-0.0	36.1	1.0	3.2	1.1	-239.9	17.8	5.2	-0.9	-0.5	1.3
0.	-1.9	-2.7	35.0	1.5	2.3	-0.0	-131.8	-10.7	3.7	-2.8	-0.8	-0.0
4.	14.9	-1.6	34.0	0.8	1.1	0.1	1.0	1.7	4.0	1.1	0.7	1.6
8.	32.5	-0.5	37.3	0.4	0.4	0.0	130.9	-1.4	0.0	-4.7	0.5	1.2
12.	47.9	-2.6	46.5	0.5	0.9	1.3	254.2	-5.2	-0.4	-4.0	1.7	3.4
16.	62.5	-3.5	57.5	-0.8	-0.1	1.3	366.6	-5.4	-9.5	-4.4	-0.5	4.4
20.	74.4	-2.5	69.4	-0.4	-4.0	-1.4	459.8	-1.0	-1.5	7.7	-3.4	3.5
25.	88.1	-1.1	89.5	0.3	-2.0	0.1	565.2	-6.2	-4.0	-0.8	-0.6	0.6
30.	98.1	-4.0	109.9	-0.8	-1.5	-1.0	660.1	4.5	-4.3	-1.1	7.8	11.7
35.	113.8	-3.0	133.1	-3.0	-0.8	1.0	728.7	-7.5	-7.1	2.3	10.8	5.8
40.	136.2	-1.1	163.8	-1.0	-3.2	-4.1	832.3	1.2	-0.8	-6.8	18.7	11.4
	YAW ANGLE= . DEG.											
-12.	-16.4	8.5	132.3	-2.6	0.7	3.1	-111.4	8.0	73.4	-5.2	-28.4	13.0
-8.	-28.3	-1.9	141.9	5.4	0.5	1.0	-118.7	-1.9	101.0	11.0	-28.7	17.4
-4.	-24.1	-10.4	136.5	2.5	3.6	0.5	-104.2	-2.9	99.3	4.5	-18.1	17.5
0.	-16.3	13.3	137.5	-0.0	2.2	-2.6	-81.7	18.1	105.4	-2.5	-26.5	12.5
4.	-21.2	3.3	136.6	-1.3	5.2	0.8	-86.5	5.8	114.5	-2.2	-32.0	7.4
8.	-27.6	-13.0	140.8	7.4	7.5	1.6	-81.9	-5.6	124.6	9.3	-37.0	9.3
12.	-11.6	7.6	139.5	1.8	6.5	0.2	-58.4	12.4	129.5	9.1	-23.5	23.9
16.	-14.4	-3.2	136.8	1.1	8.1	2.8	-53.6	-2.0	136.4	5.7	-17.4	14.7
20.	-11.7	-11.0	133.4	0.3	7.9	5.0	-38.5	1.6	125.4	-2.3	-14.2	31.6
25.	-9.1	-2.0	133.2	-1.2	8.6	2.3	-30.1	3.2	121.6	-12.3	-21.4	13.9
30.	-13.2	-8.4	135.0	1.7	11.3	6.5	-18.5	-3.6	132.6	2.7	-0.7	13.5
35.	-5.9	-3.6	134.5	0.3	7.6	4.2	1.1	6.9	128.0	-5.9	-8.2	32.5
40.	-6.4	2.4	134.5	-1.7	8.4	-1.2	12.3	6.5	131.2	-6.6	-10.3	14.3



(A) RIGHT SIDE VIEW

FIGURE 1. - PHOTOGRAPHIC VIEWS OF D5 BULLDOZER MODEL.



(B) LEFT SIDE VIEW

FIGURE 1. - Continued.



(C) VIEW OF D5 BULLDOZER WITH BLADE

FIGURE 1. - CONCLUDED.



(A) RIGHT SIDE VIEW

FIGURE 2. - PHOTOGRAPHIC VIEWS OF M109 MODEL.



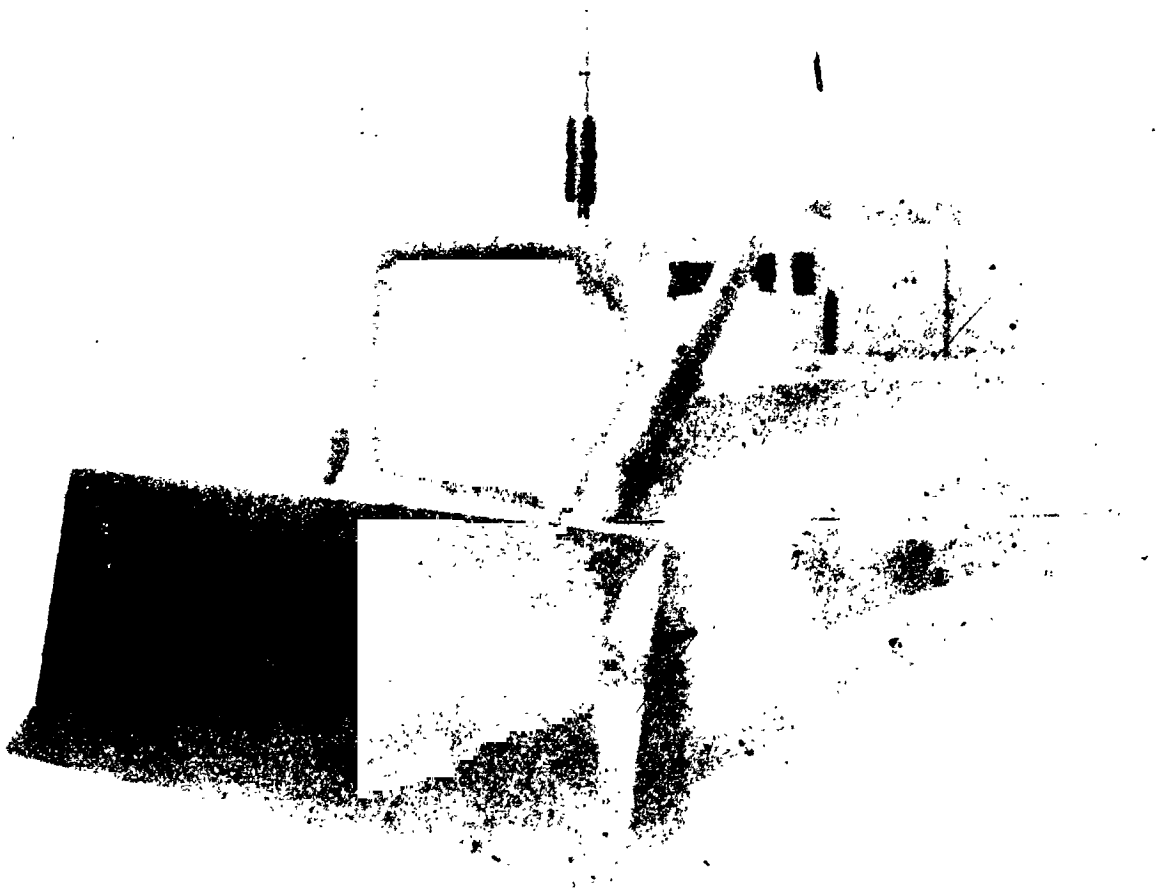
(B) REAR VIEW

FIGURE 2. - CONCLUDED.



(A) D5 BULLDOZER MODEL FORWARD CONFIGURATION

FIGURE 3. - D5 BULLDOZER MODEL CONFIGURATIONS MOUNTED IN TUNNEL.



(B) D5 BULLDOZER/BLADE MODEL CONFIGURATION

FIGURE 3. - CONTINUED.



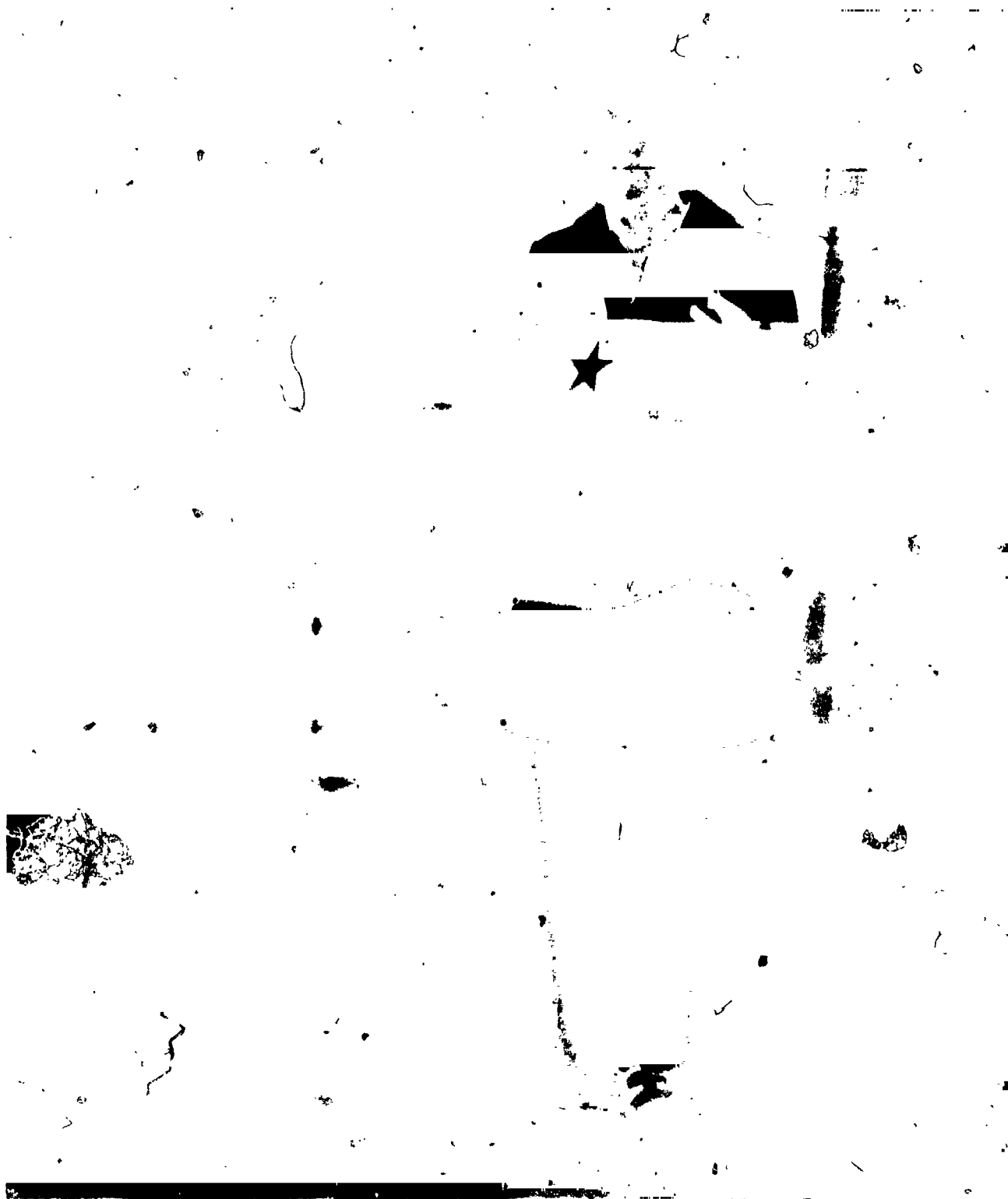
(C) D5 BULLDOZER MODEL REVERSE CONFIGURATION

FIGURE 3. - CONCLUDED.



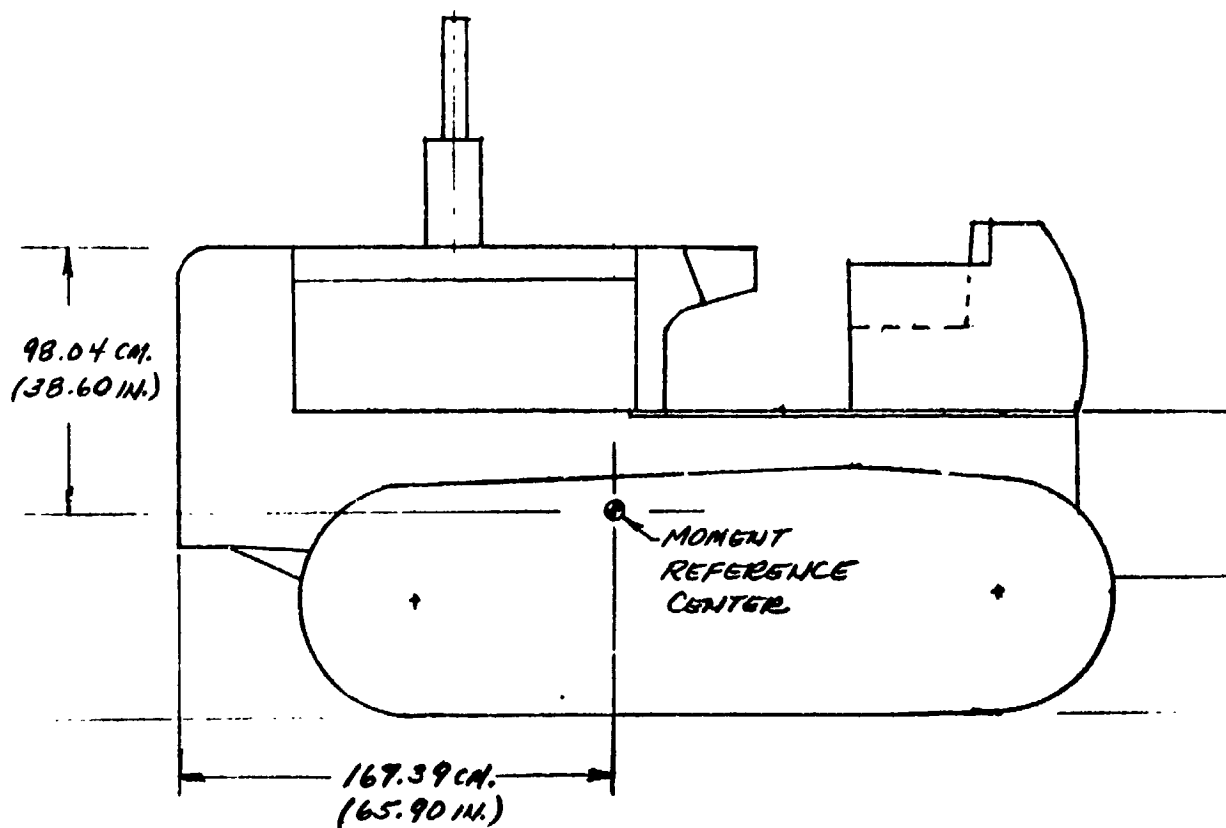
(A) M109 MODEL FORWARD CONFIGURATION

FIGURE 4. - M109 MODEL CONFIGURATIONS MOUNTED IN TUNNEL.

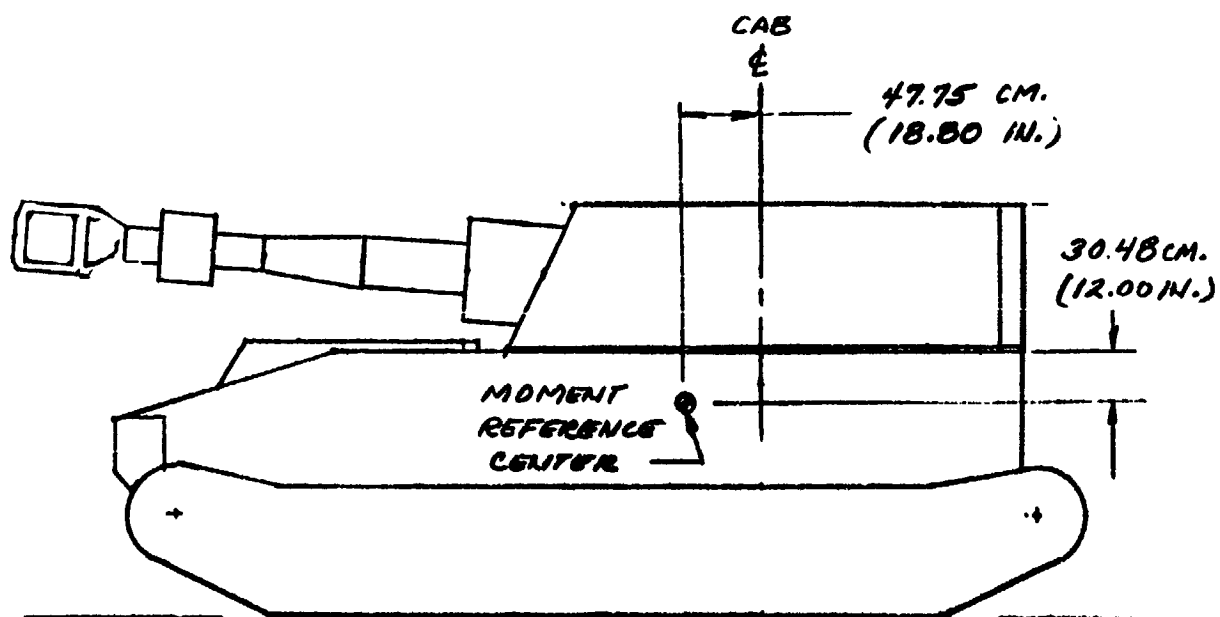


(B) M109 MODEL REVERSE CONFIGURATION

FIGURE 4. - CONCLUDED.

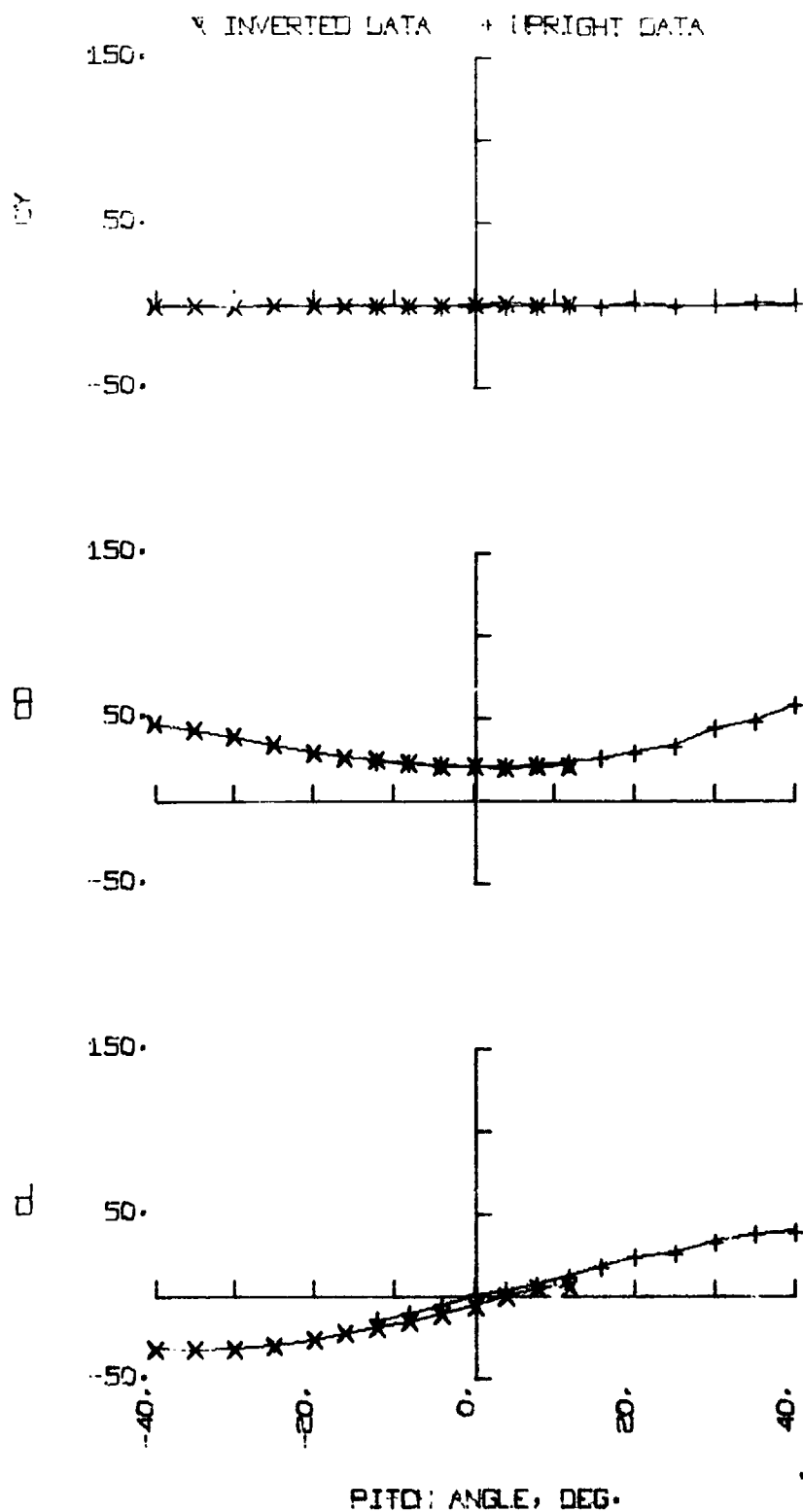


(A) M5 BULLDOZER



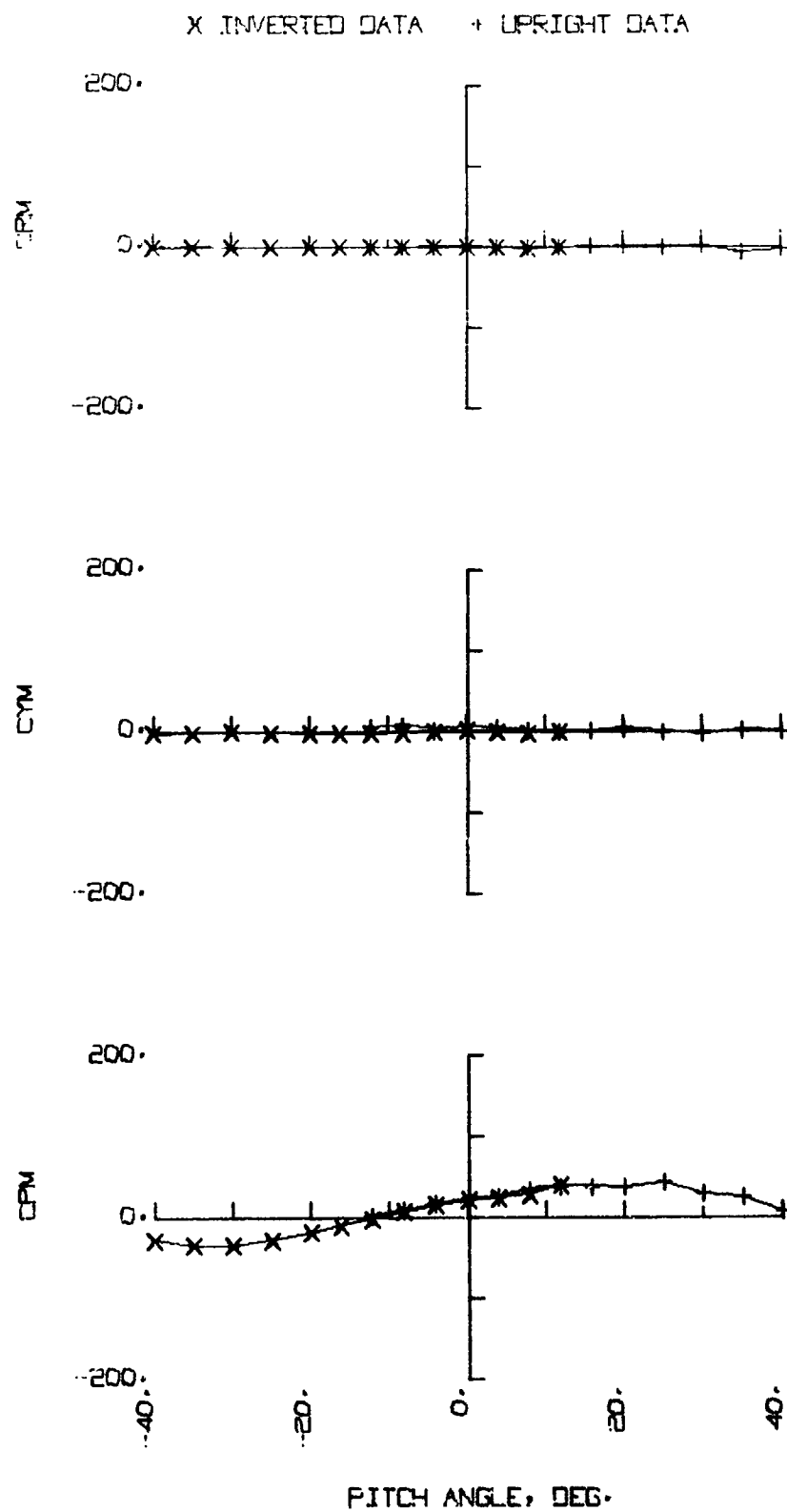
(B) M109 SELF-PROPELLED 155 MM HOWITZER

FIGURE 5. - LOCATION OF MOMENT REFERENCE CENTER.



(A) FORCE COEFFICIENTS, YAW ANGLE=0.

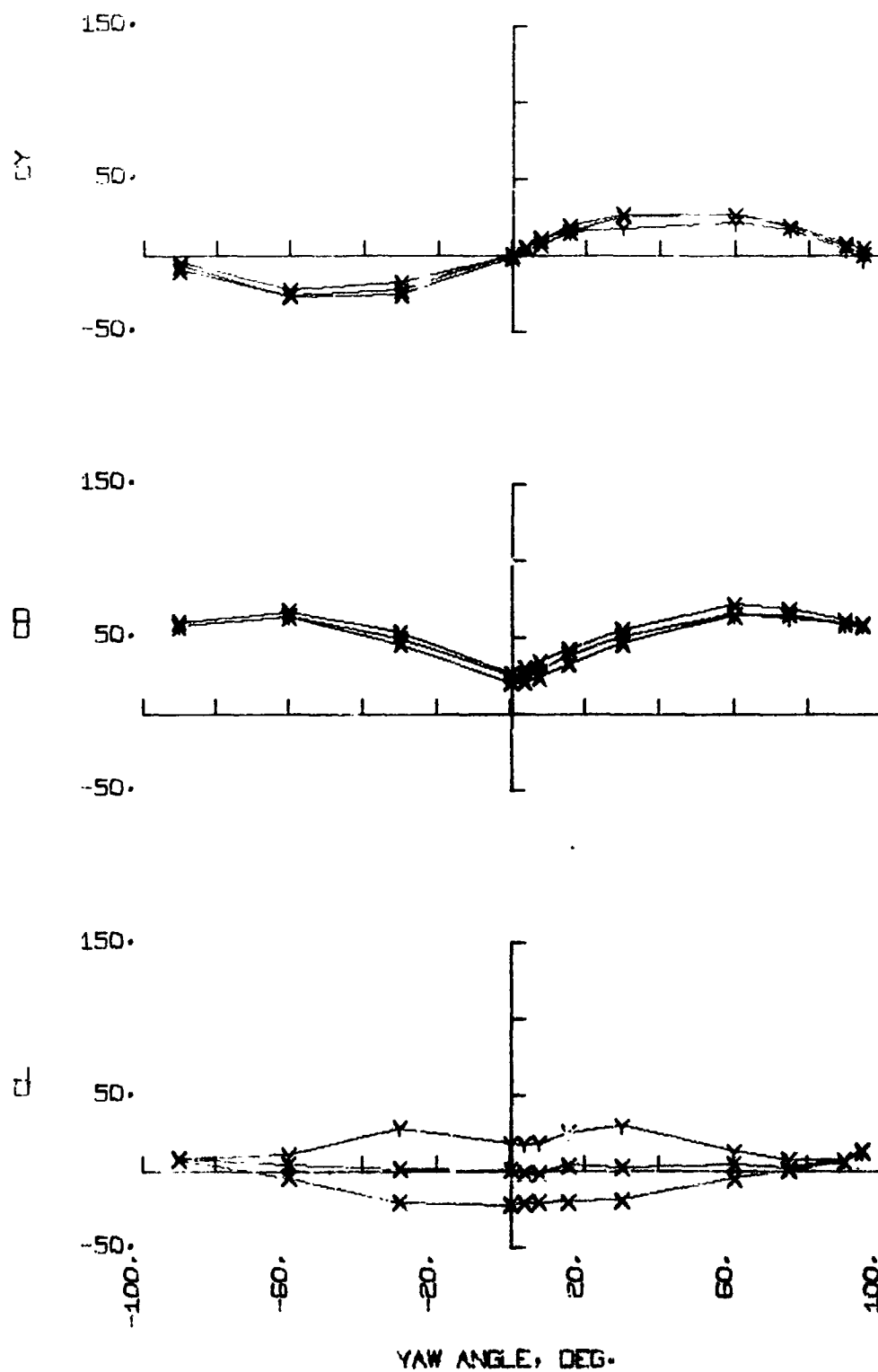
FIGURE 6. - AERODYNAMIC CHARACTERISTICS OF CS BULLOZER FORWARD CONFIGURATION.



(B) MOMENT COEFFICIENTS, YAW ANGLE=0.

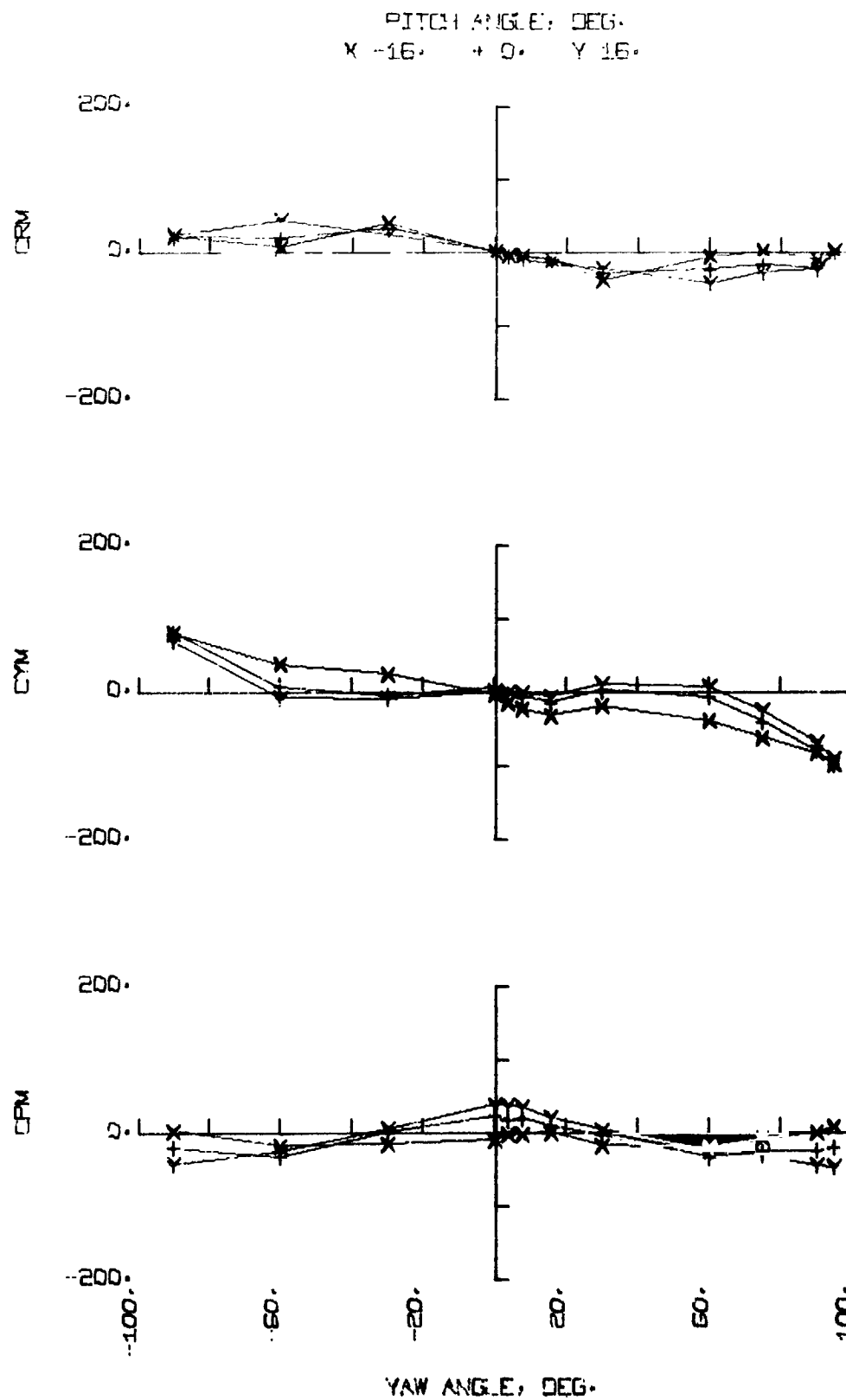
FIGURE 6. - CONTINUED.

PITCH ANGLE, DEG.
X -16. + 0. Y 16.



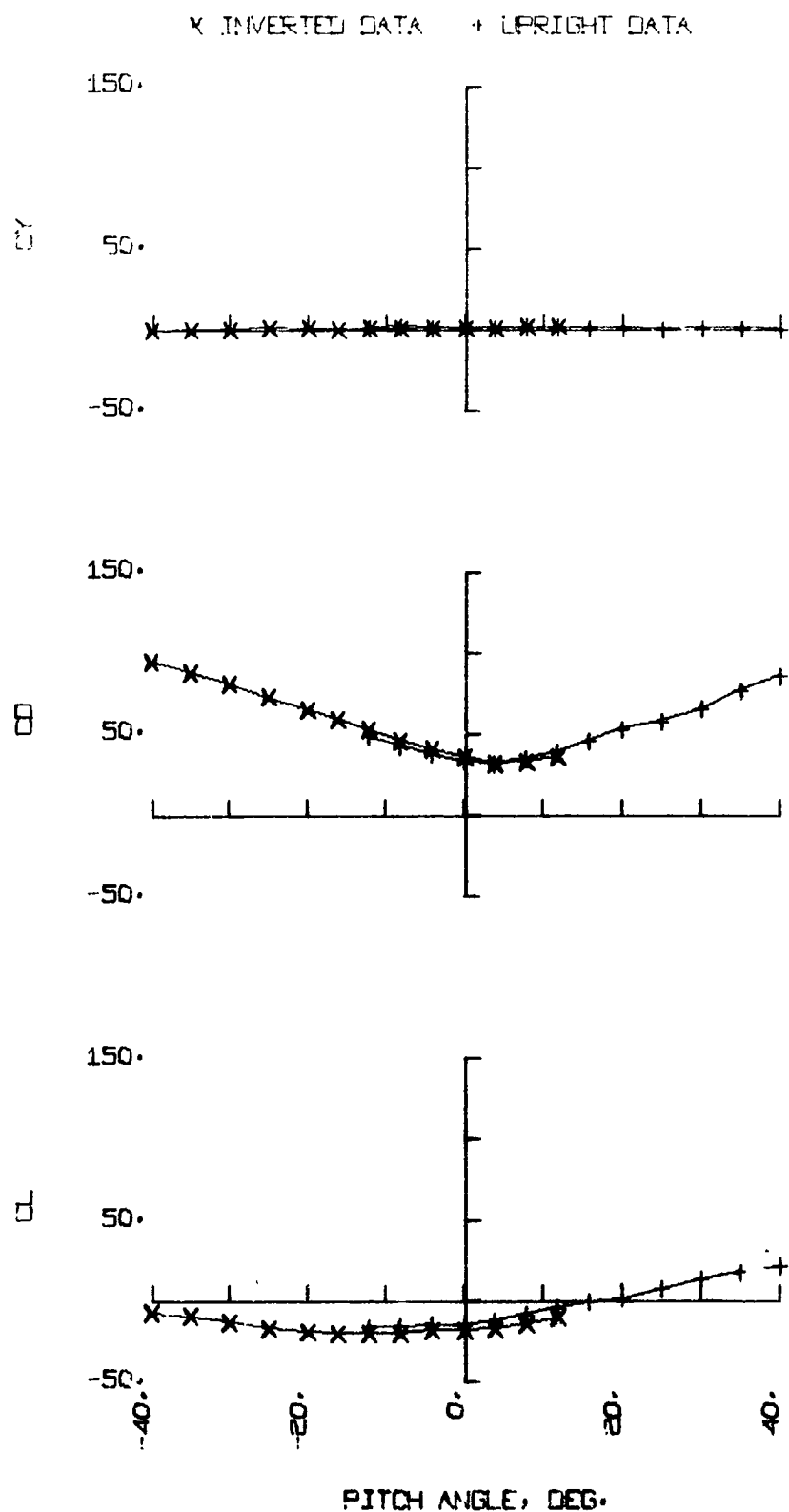
(C) FORCE COEFFICIENTS, PITCH ANGLES=-16.,0.,16.

FIGURE 6. - CONTINUED.



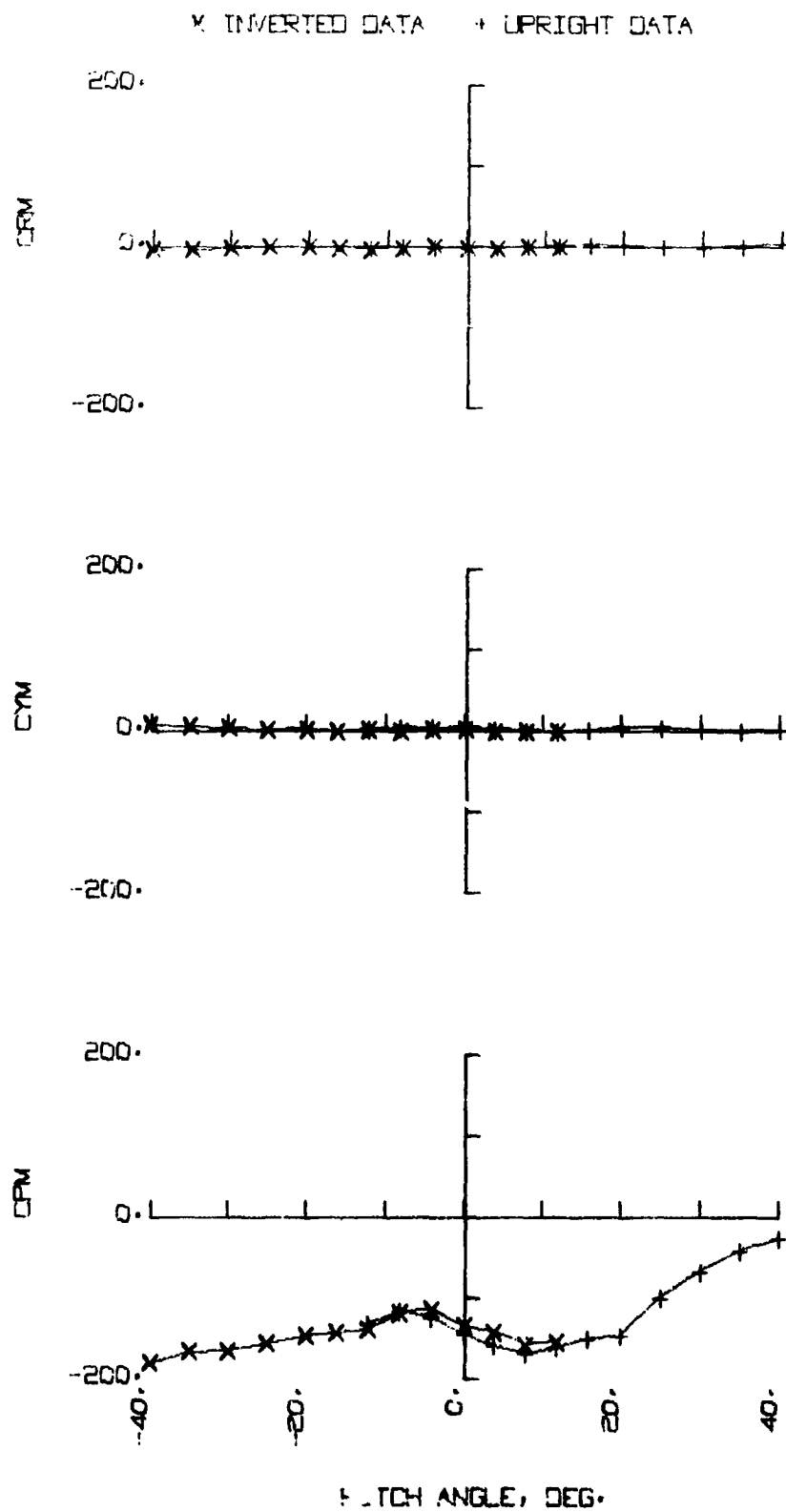
(D) MOMENT COEFFICIENTS, PITCH ANGLES=-16.,0.,16.

FIGURE 6. - CONCLUDED.



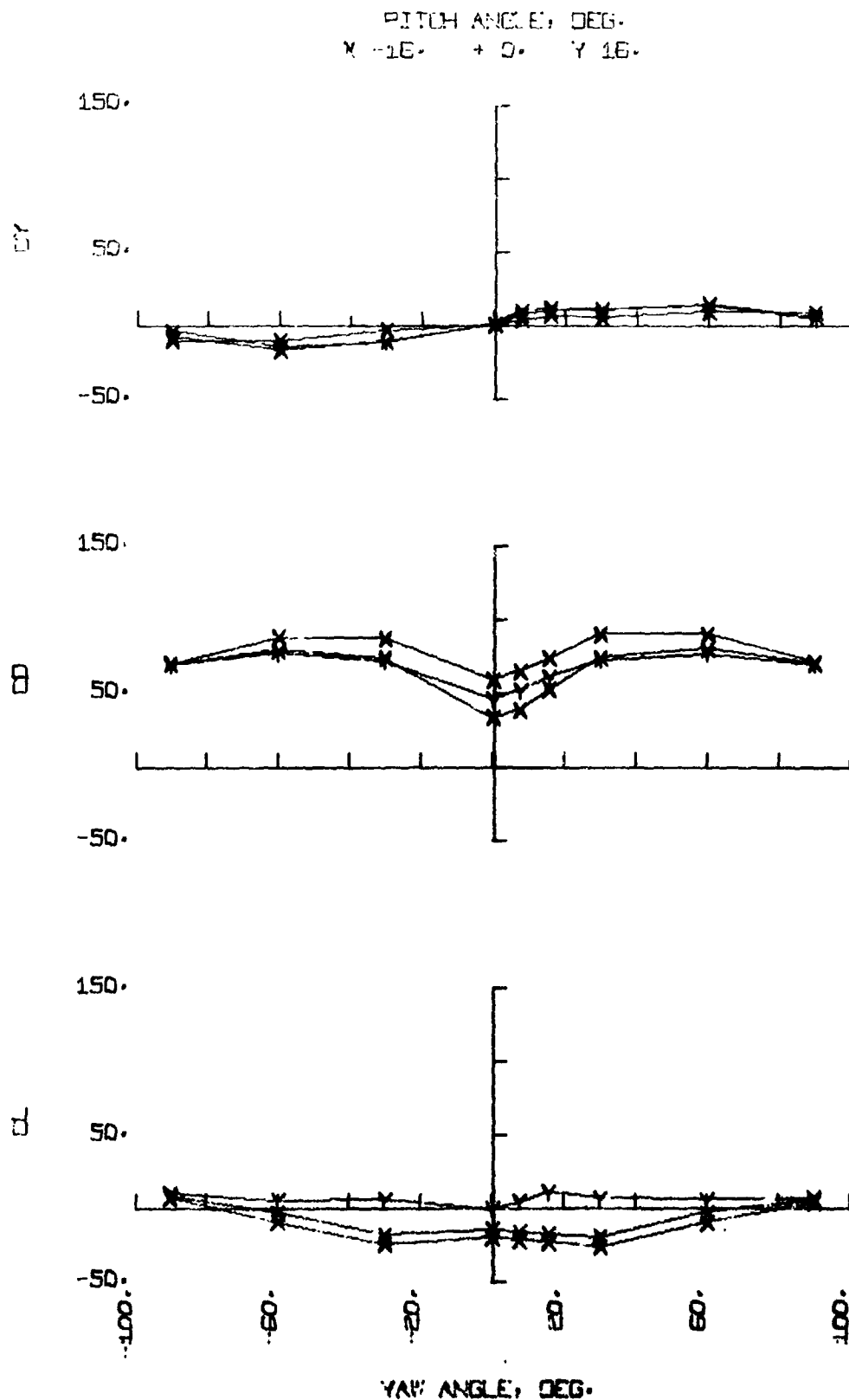
(A) FORCE COEFFICIENTS, YAW ANGLE=0.

FIGURE 7. - AERODYNAMIC CHARACTERISTICS OF D5 BULLDOZER/BLADE CONFIGURATION.



(B) MOMENT COEFFICIENTS, YAW ANGLE=0.

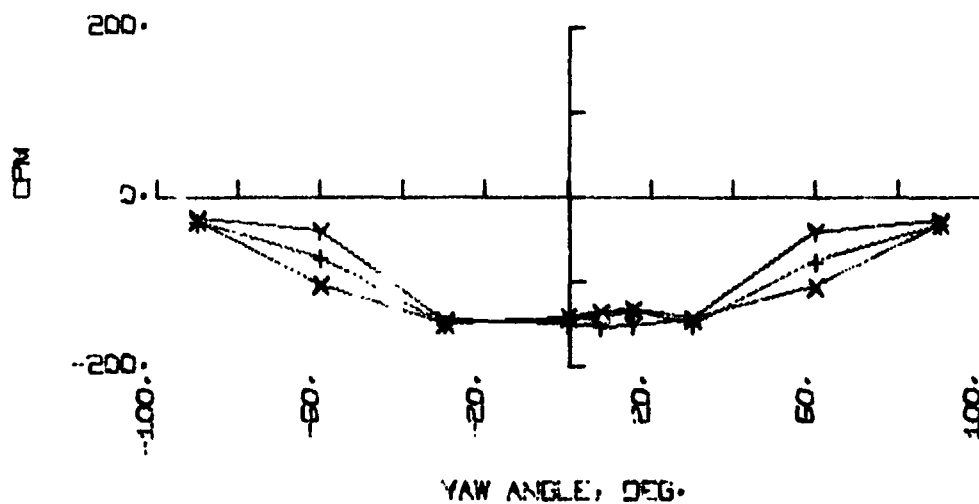
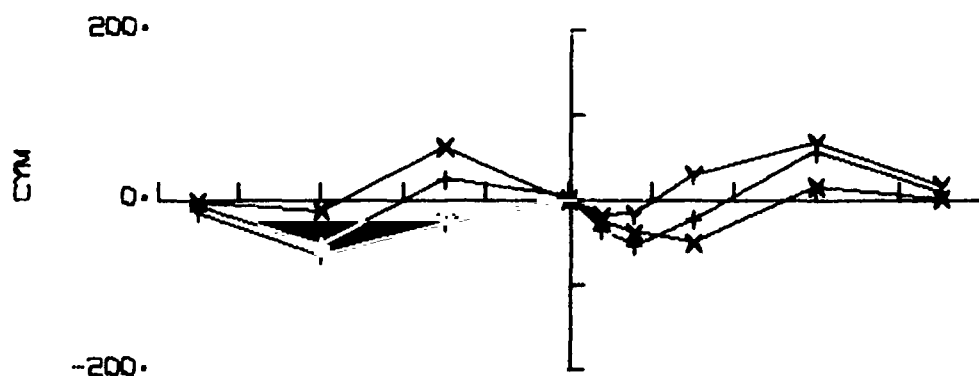
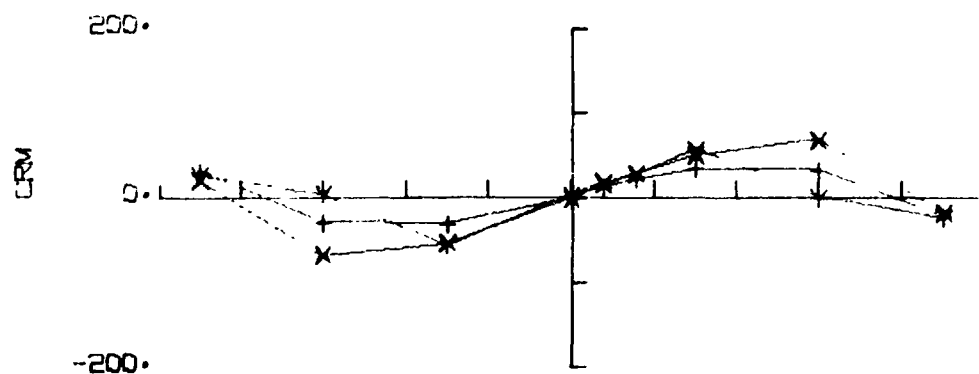
FIGURE 7. - CONTINUED.



(C) FORCE COEFFICIENTS, PITCH ANGLES=-16.,0.,16.

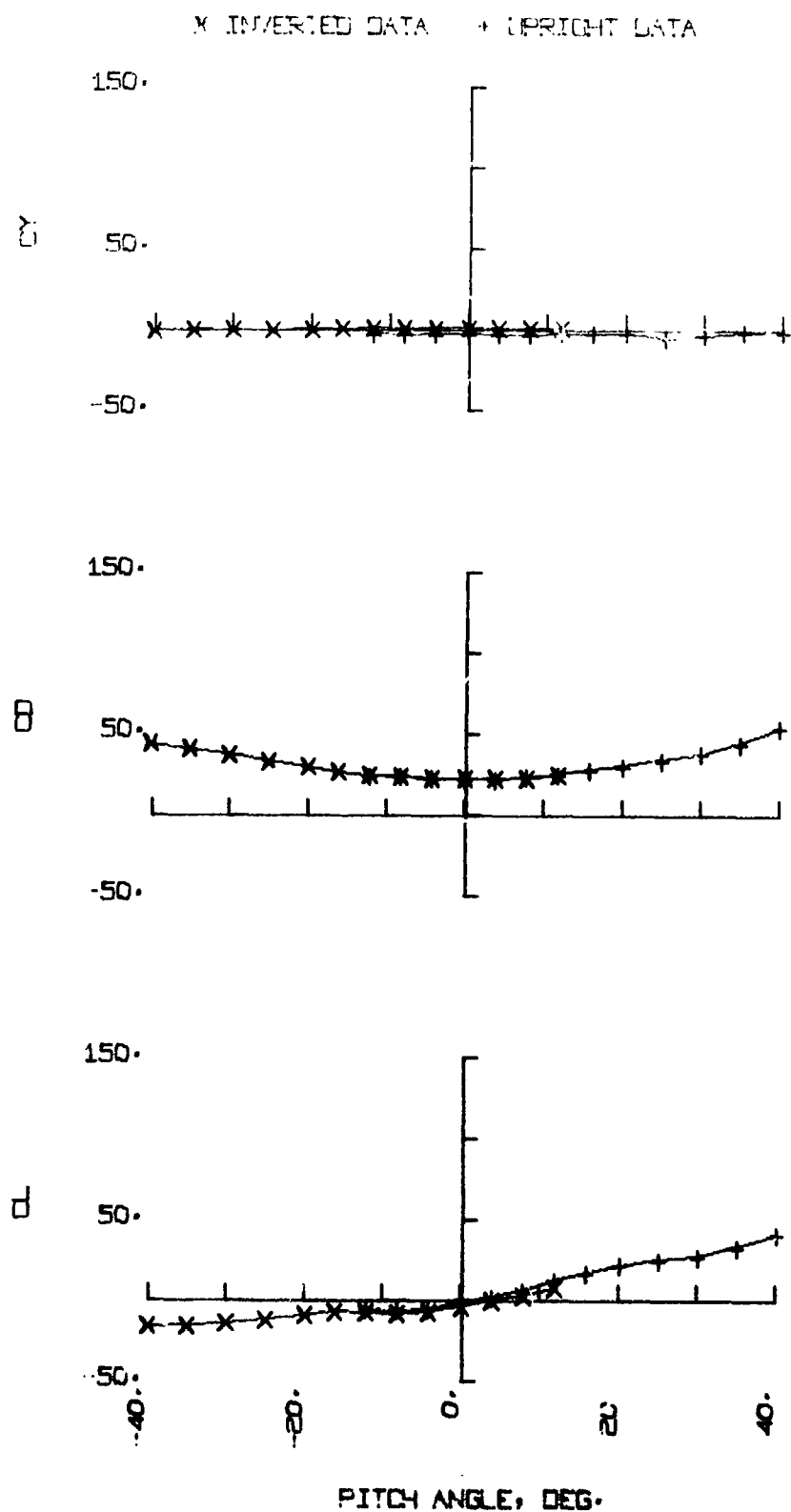
FIGURE 7. - CONTINUED.

PITCH ANGLE, DEG.
X -16. + 0. Y 16.



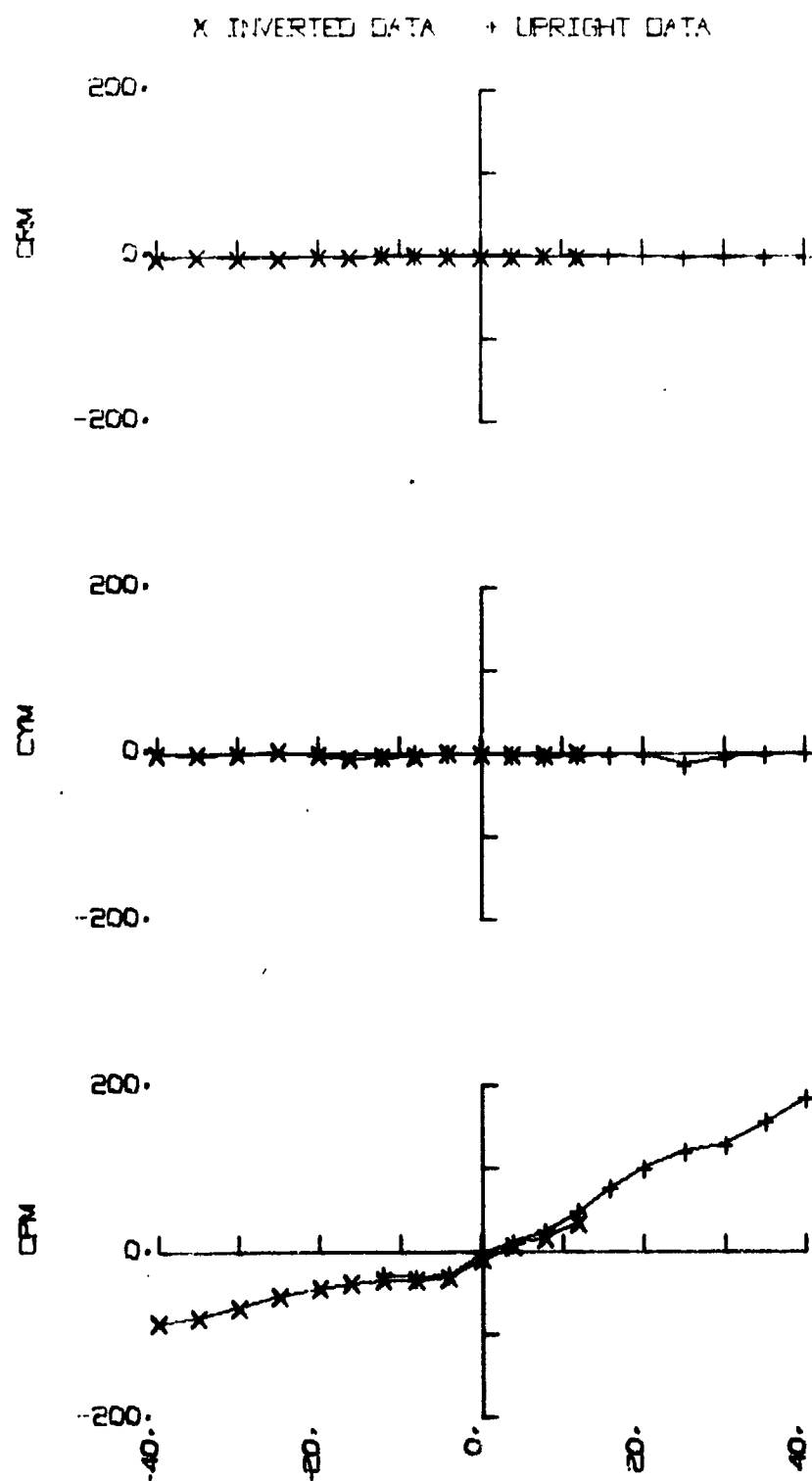
(D) MOMENT COEFFICIENTS, PITCH ANGLES=-16.,0.,16.

FIGURE 7. - CONCLUDED.



(A) FORCE COEFFICIENTS, YAW ANGLE=0.

FIGURE 8. - AERODYNAMIC CHARACTERISTICS OF DS BULLDOZER
REVERSE CONFIGURATION.

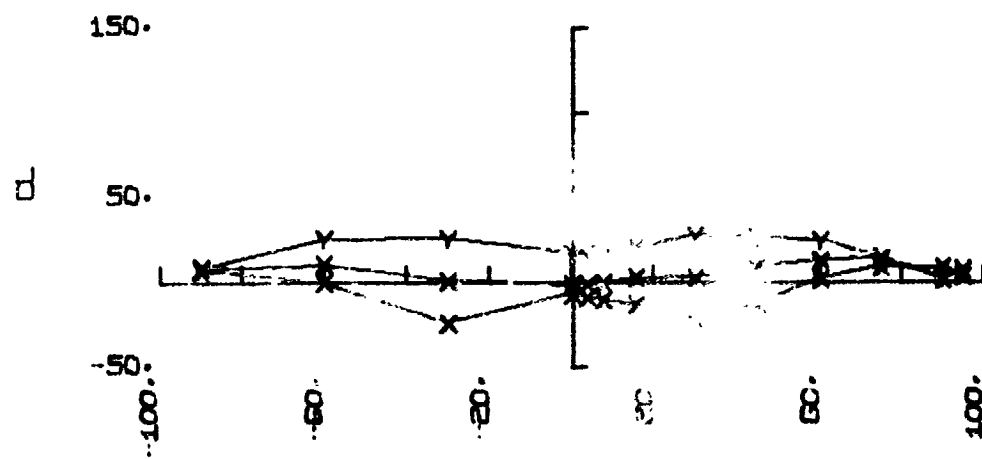
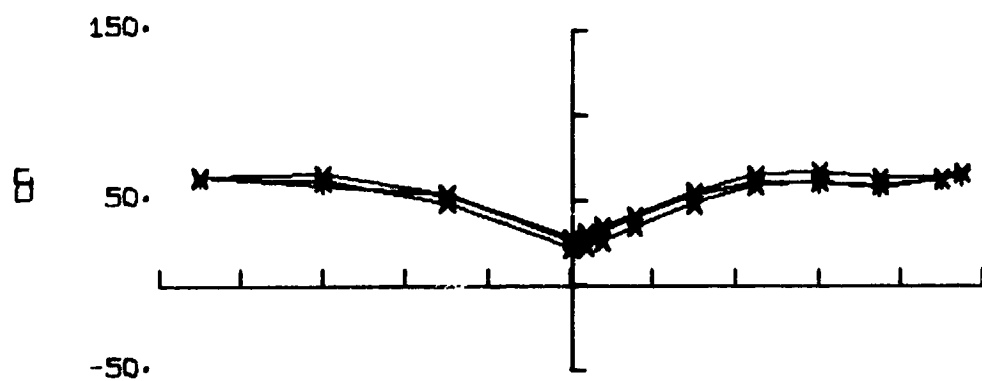
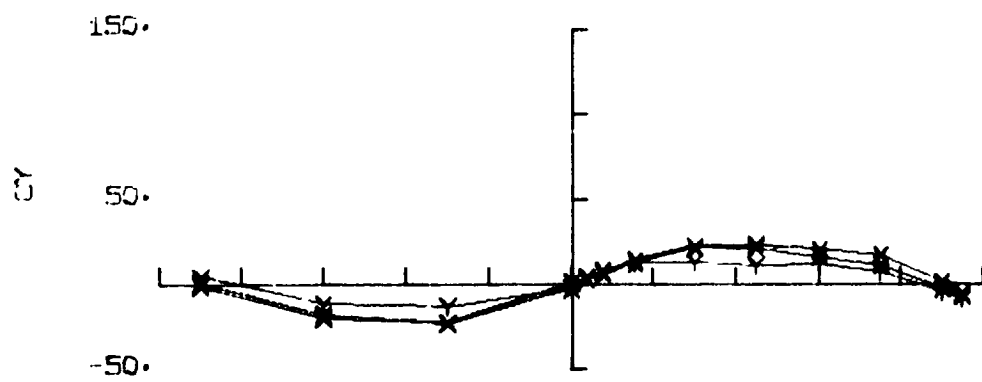


PITCH ANGLE, DEG.

(B) MOMENT COEFFICIENTS, YAW ANGLE=0.

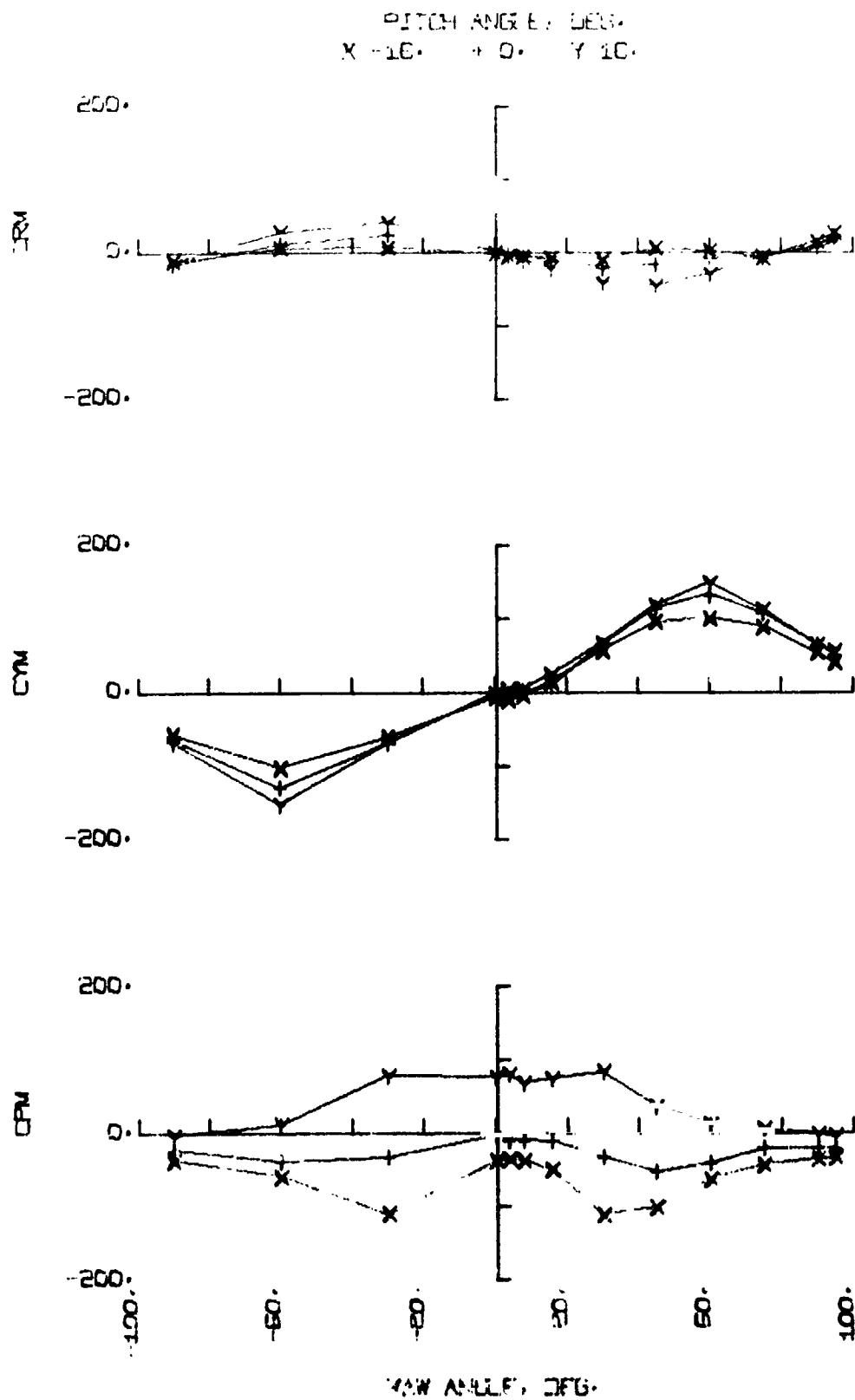
FIGURE 8. - CONTINUED.

PITCH ANGLE, DEG.
X -16. O 0. Y 16.



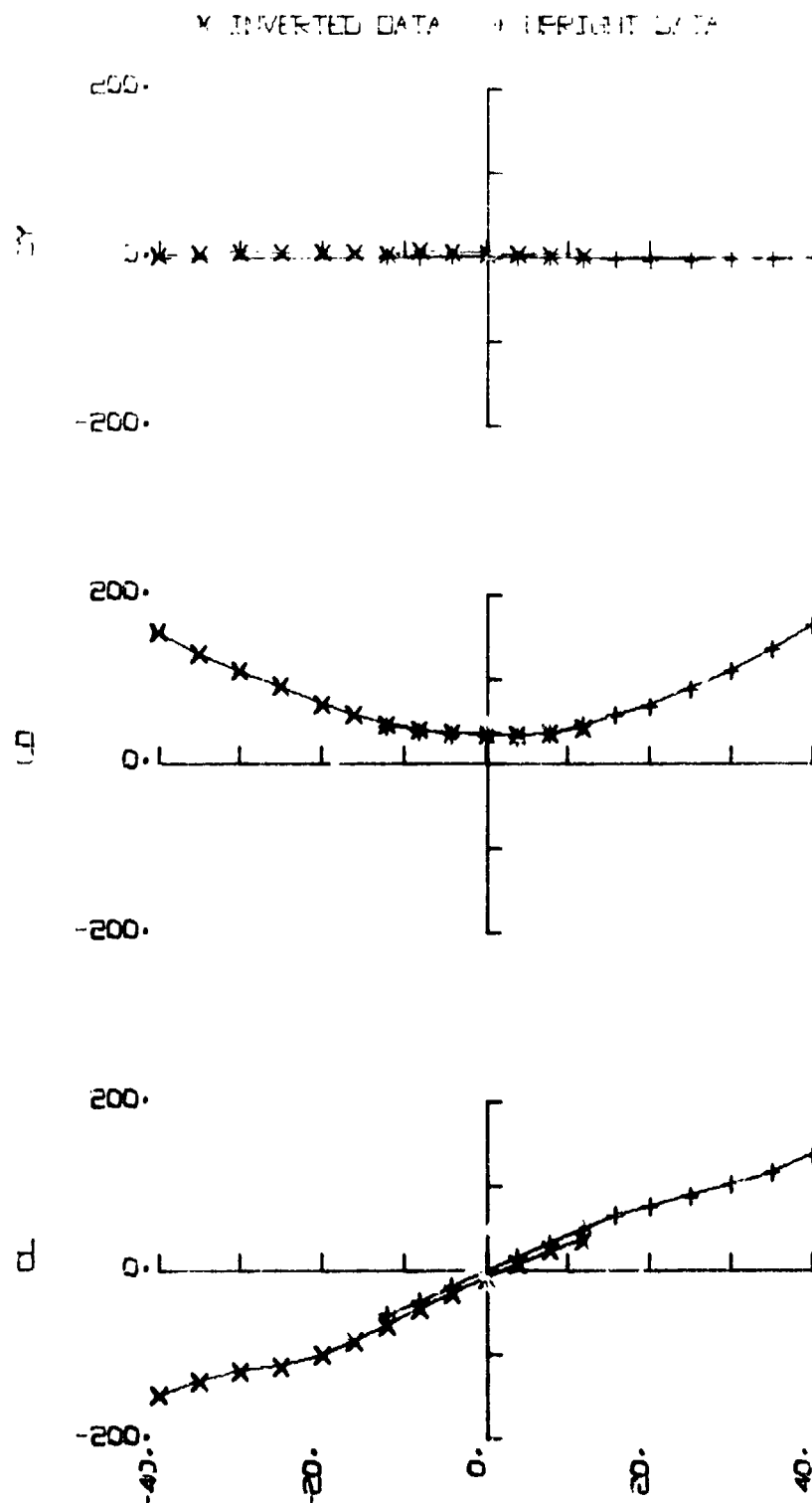
(C) FORCE COEFFICIENTS, PITCH ANGLES=-16.,0.,16.

FIGURE 8. - CONTINUED.



(D) MOMENT COEFFICIENTS, PITCH ANGLES=-16..0..16.

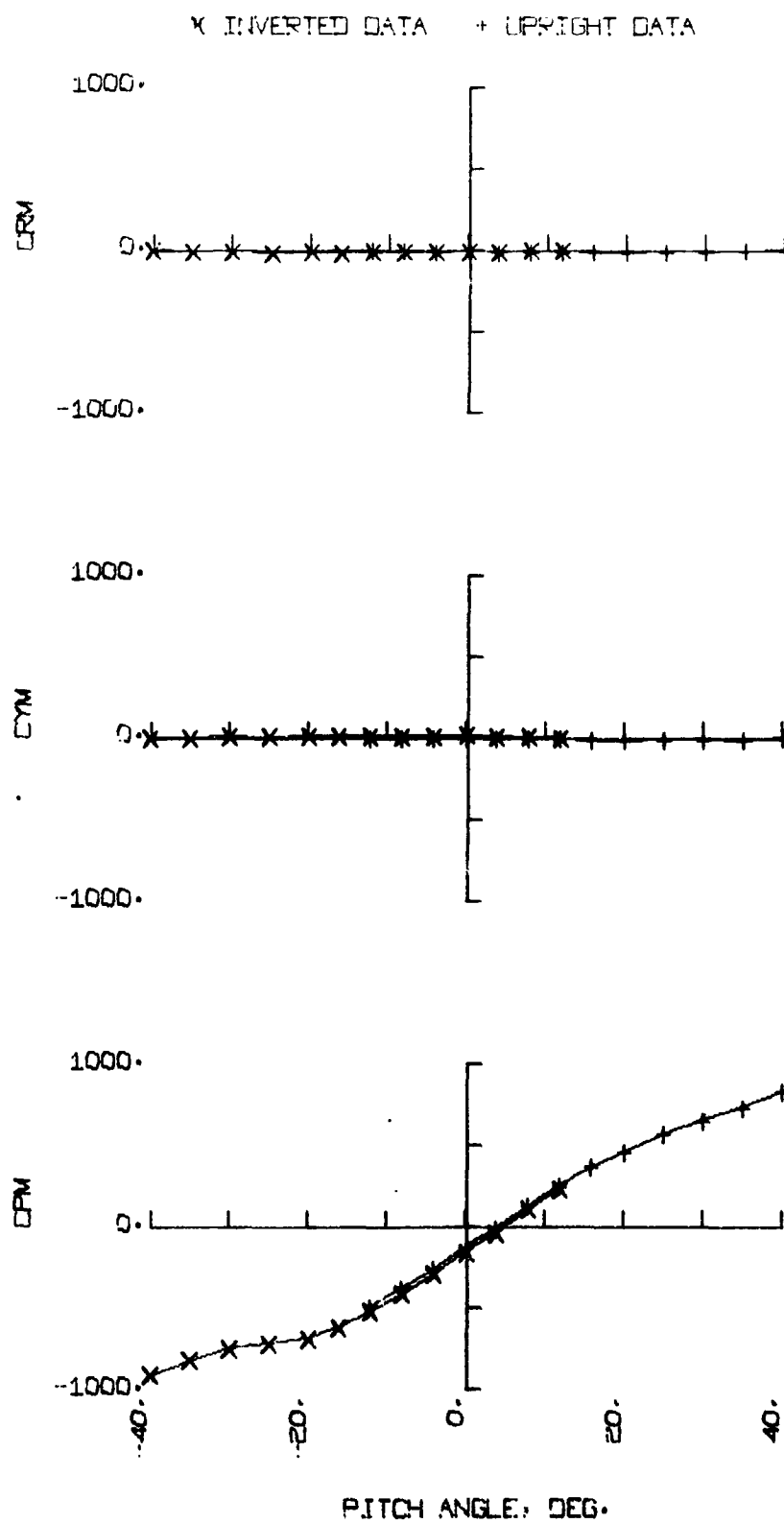
FIGURE 8. - CONCLUDED.



PITCH ANGLE, DEG.

(A) FORCE COEFFICIENTS, YAW ANGLE=0.

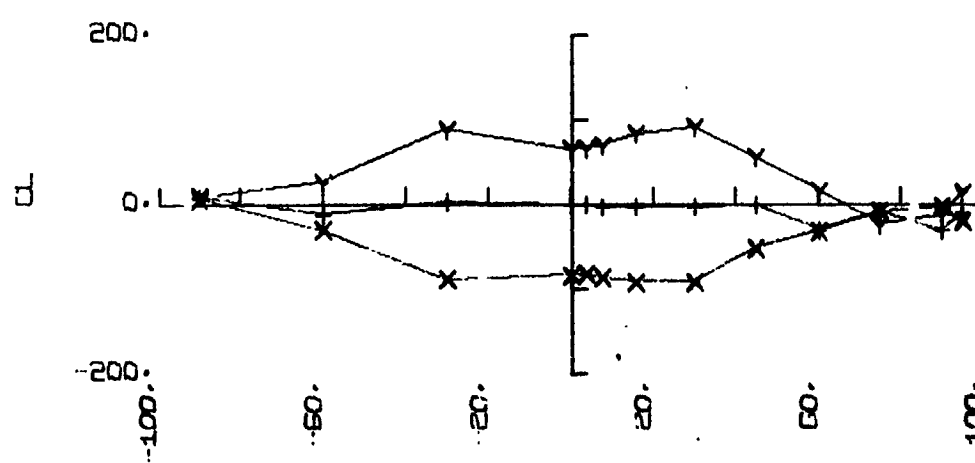
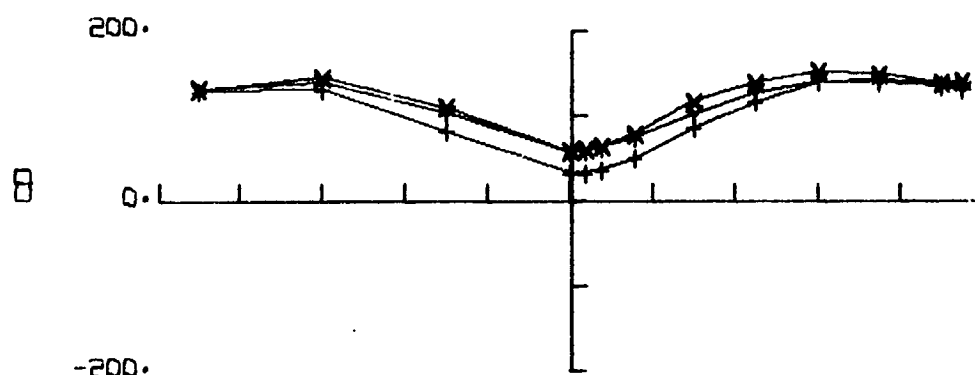
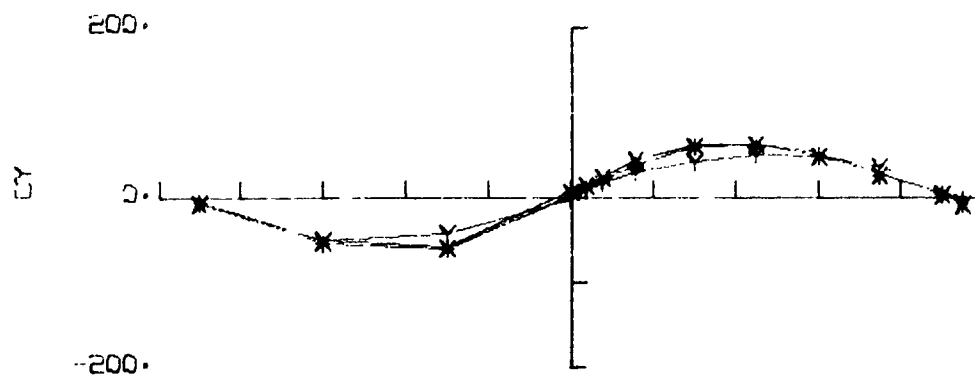
FIGURE 9. - AERODYNAMIC CHARACTERISTICS OF M100 FORWARD CONFIGURATION.



(B) MOMENT COEFFICIENTS, YAW ANGLE=0.

FIGURE 9. - CONTINUED.

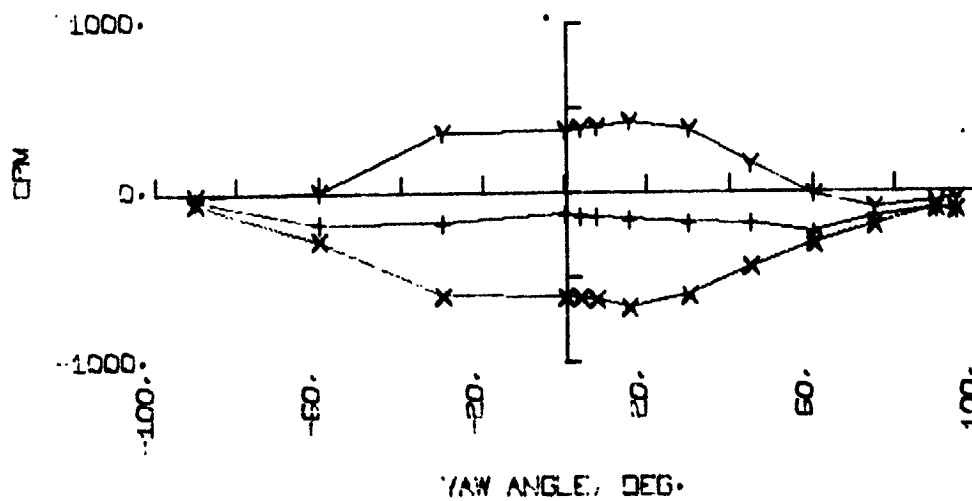
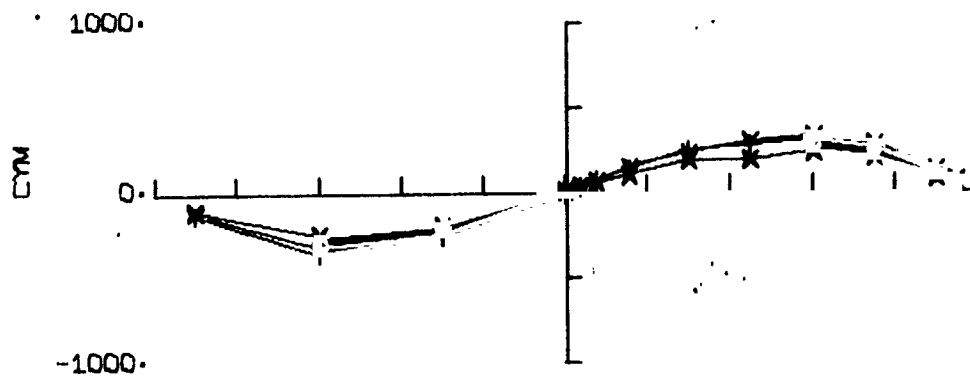
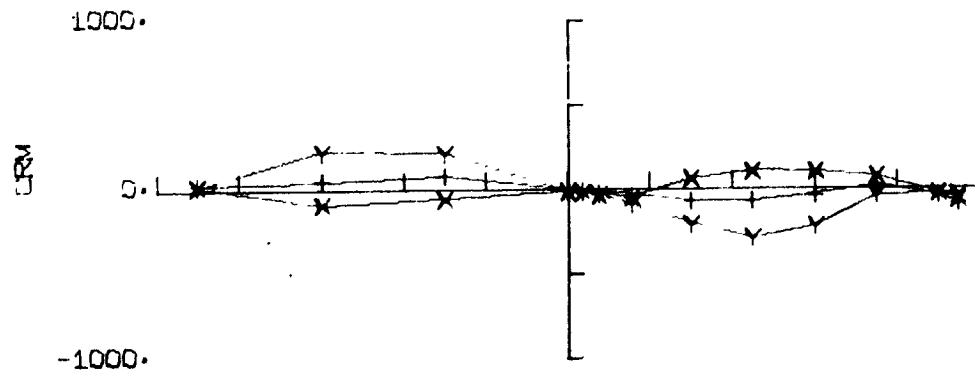
PITCH ANGLE, DEG.
X -16. + 0. Y 16.



YAW ANGLE, DEG.
(C) FORCE COEFFICIENTS, PITCH ANGLES=-16.,0.,16.

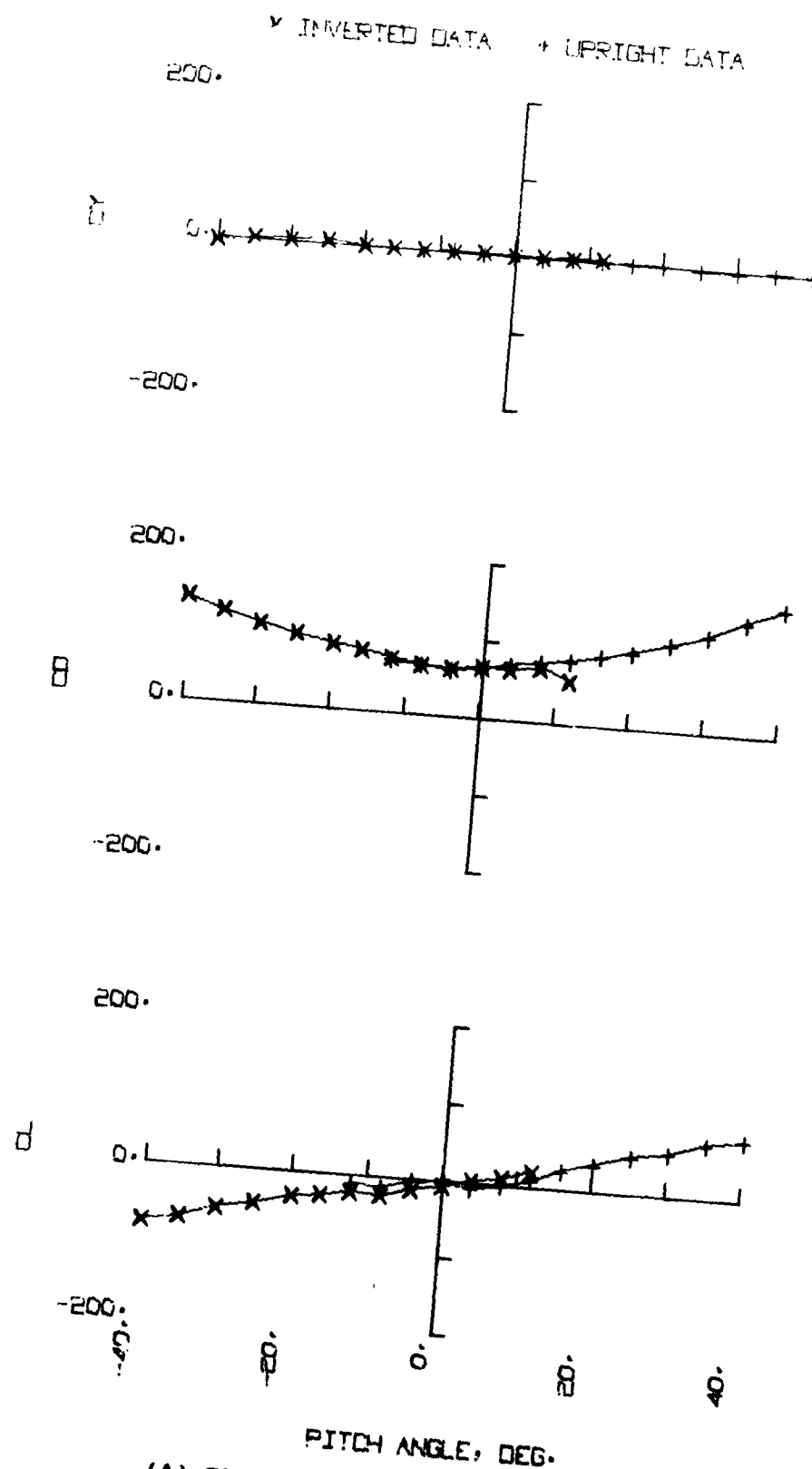
FIGURE 9. - CONTINUED.

PITCH ANGLE, DEG.
X -16. + 0. Y 16.



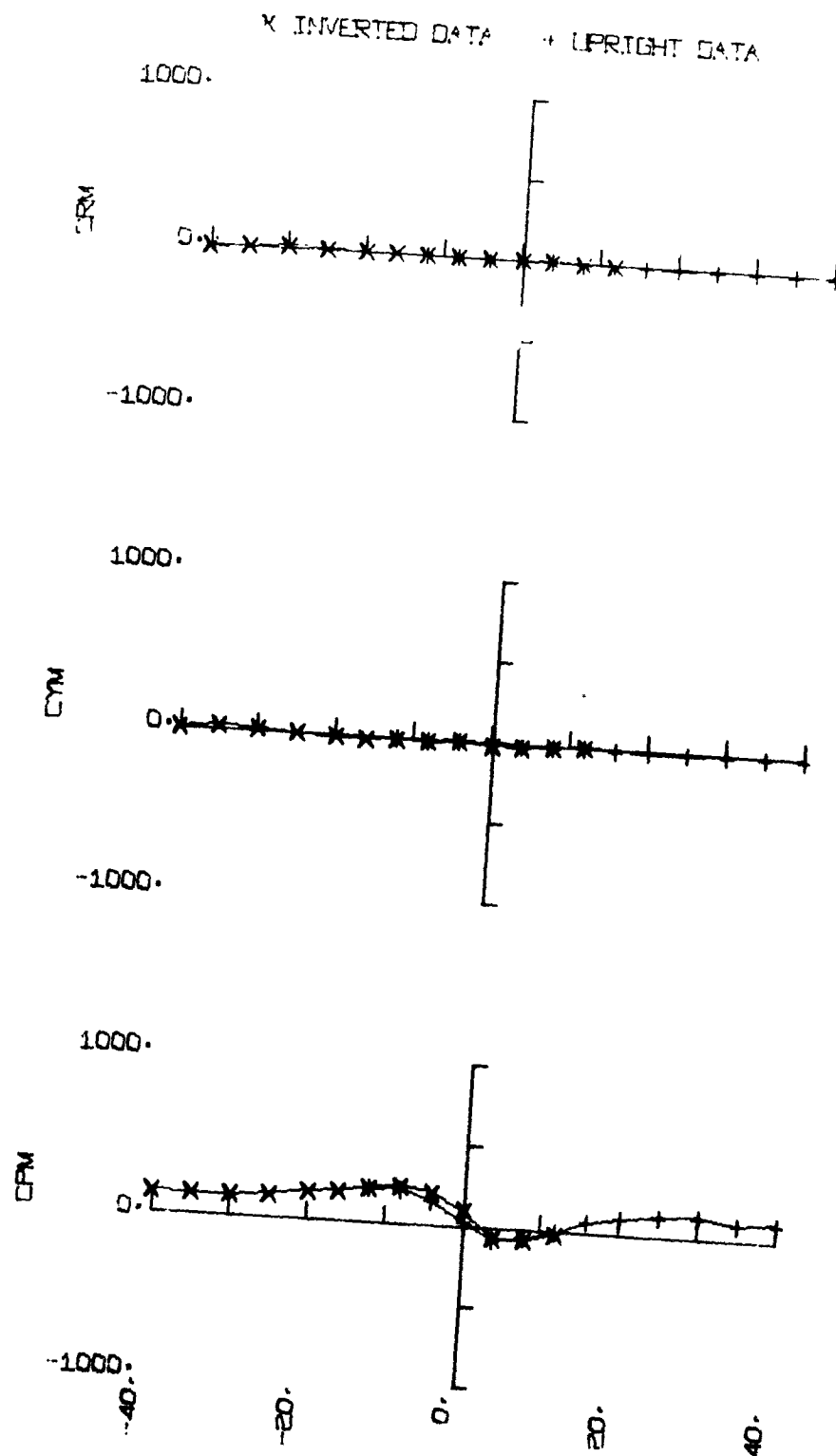
(D) MOMENT COEFFICIENTS, PITCH ANGLES=-16.,0.,16.

FIGURE 9. - CONCLUDED.



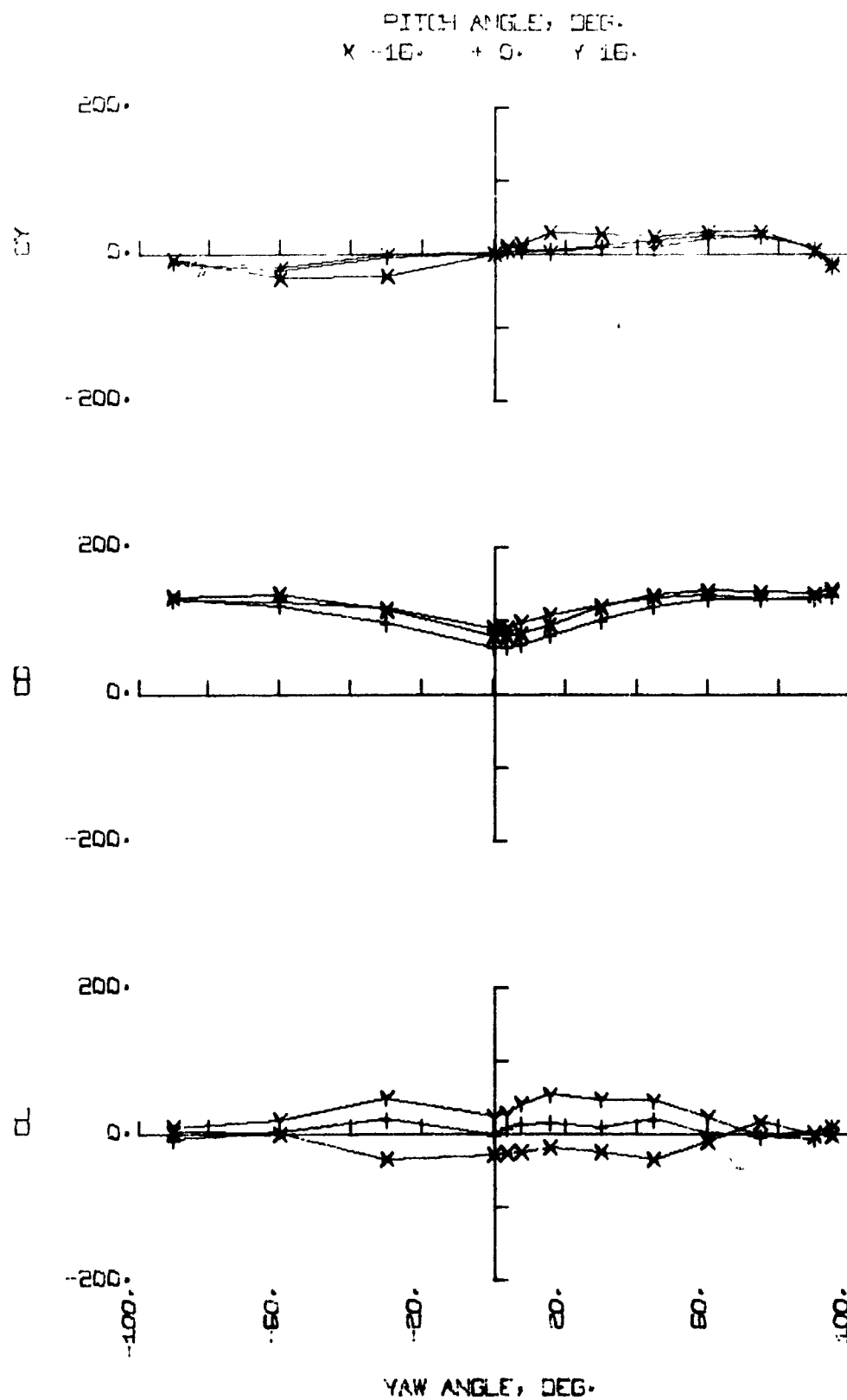
(A) FORCE COEFFICIENTS, YAW ANGLE=0.

FIGURE 10. - AERODYNAMIC CHARACTERISTICS OF M109 REVERSE CONFIGURATION.



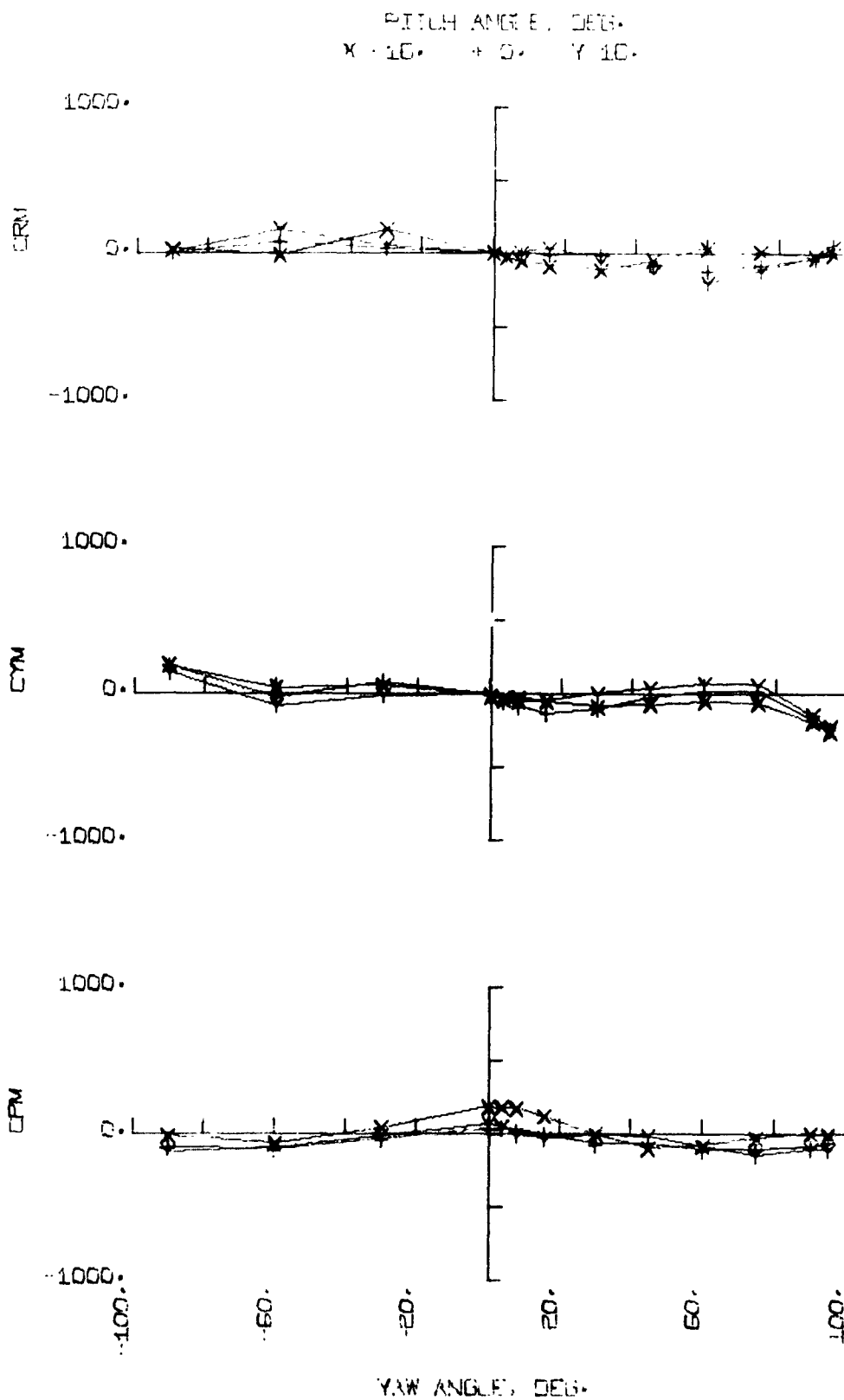
(B) MOMENT COEFFICIENTS, YAW ANGLE=0.

FIGURE 10. - CONTINUED.



(C) FORCE COEFFICIENTS, PITCH ANGLES=-16.,0.,16.

FIGURE 10. - CONTINUED.



(D) MOMENT COEFFICIENTS, PITCH ANGLES=-16..0..16.

FIGURE 10. - CONCLUDED.